THE MODEL ENGINEER

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THE MODEL ENGINEER

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Our Cover Picture

At this time of the year, the Live Steam fraternity thinks in terms of outdoor tracks, and, as time goes on, it seems that the younger generation, too, has acquired the habit of looking for the chance of a ride behind a nice miniature steam locomotive. At almost any fete, church garden-party, or some such function, the passenger-hauling railway is now usually to be found among the attractions; even in public parks, it is by no means a rarity during the summer months. Our cover-picture is from a photograph sent us by Wing Commander P. N. Isaac, of Flying Training Command, who took it in Prospect Park, Reading. The track, which is, we believe, a portable one, is occupied by a 7¼-in. gauge S.R. "King Arthur," with a train of happy youngsters.

SMOKE RINGS

Radio Control Regulations

WE HAVE received a recent publication issued by the G.P.O. regarding the regulations now in force for radio controlled models and note that licences are now required to operate radio transmitters of any kind, including the remote control of models and similar purposes.

The cost of the licence is £1 and application forms can be obtained from the Radio Accommodation Department, Radio Branch, G.P.O. Headquarters, London, E.C.1. Alternatively, the licence fee can be remitted giving name and address and where the set is normally operated. If it is desired to operate away from the normal area, the Telephone Manager of the area in which the transmitter is to be used should be notified. In the case of Regattas and similar organised contests, the organisers should inform the local Telephone Manager that a number of sets will be operating all day, and advise competitors that it will be unnecessary to do so individually.

No tests of apparatus will be necessary as a condition of obtaining a licence, and the transmitters need not carry any distinguishing numbers or call signs.

Appleford Traction Engine Rally

BY THE time that this note can be published, preparations for the National Traction Engine Rally at Bridge Farm, Appleford, Berks., on June 12th, will be completed. The only doubtful element is, of course, the weather, and everybody concerned hopes for a fine day.

Of particular interest to model makers is the decision, this year, to allot a corner of the field to model traction engines; facilities will be available for steaming and demonstrating the models as an added side-show to the full-size rally. Any reader who is able to take along a model for this purpose should communicate immediately with the Secretary, M.T.E. & T.A. Inc., Duke Street Chambers, Duke Street, Reading, Berks., giving particulars of the model.

The field will be open, to enthusiasts and photographers, from 10.30 a.m.; to the general public, at 2.30 p.m., and the first event, a Grand Parade, will take place at 3.30 p.m. Travellers by road to the rally should note that traffic converging on Appleford will be routed by way of Abingdon, Wallingford and Didcot.

A Tonbridge Get-Together

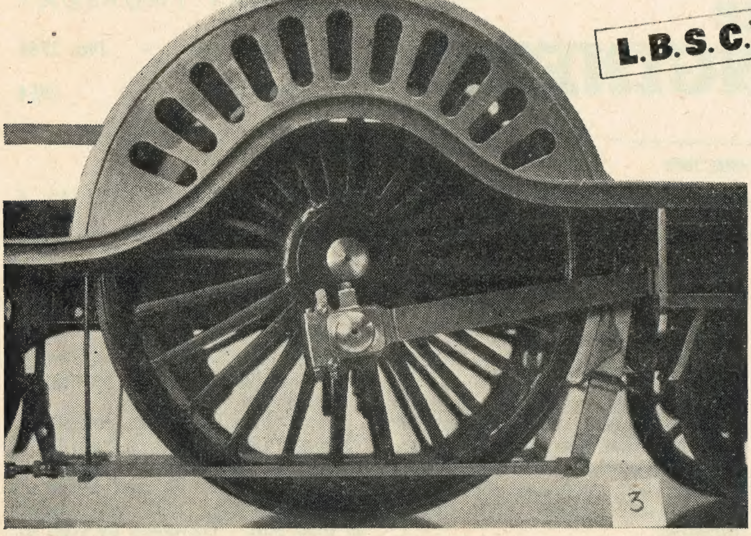
A GLORIOUSLY fine afternoon favoured a happy-get-together at the Tonbridge Model Engineering Society's locomotive track on May 8th. About a dozen locomotives were steamed; some of them had been brought from neighbouring socities at East Grinstead, Maidstone and Sevenoaks. All of them behaved very well, and they varied from a *Tich* (built double-size, for 5-in. gauge) to a very fine 3½-in. gauge *Hielan' Lassie*. Perhaps, the speediest of them was a "Jeanie Deans" type Webb compound engine, built by the Tonbridge society's hon. secretary Mr. R. H. Proctor, which put up a spurt that must have been at least 10 m.p.h. on 3½-in. gauge.

Another interesting engine for the same gauge was a fine G.W.R. "County" class engine, which had not previously been steamed; in fact, it had been completed in the very early hours of the same day, but she did very well. Others present included: a double-size "Dyak," a "Pamela," an "Iris," a "P. V. Baker" and a *Royal Scot*, and all exhibited excellent workmanship as well as plenty of power and speed. Mr J. N. Maskelyne "mounted the footplate" of nearly all of them, in turn, and found each of them to be in fine fettle.

Altogether, it was a most enjoyable afternoon, typical of what such a gathering should be.

L.B.S.C.'s Lobby Chat

YOU HAVE BEEN WARNED!



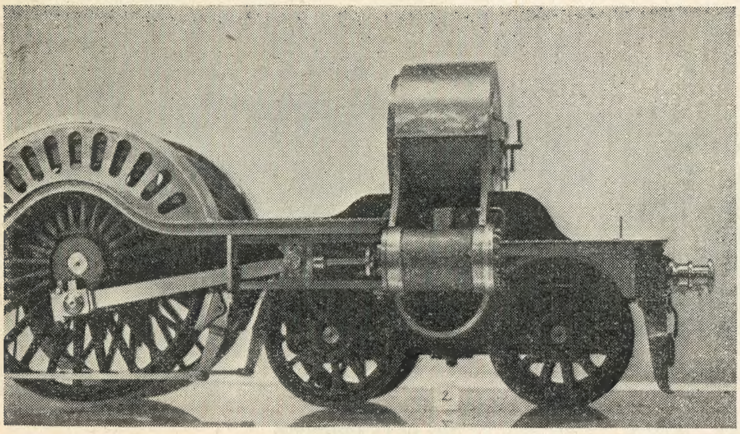
" *The Real Goods* "

MANY readers were doubtless amused, as I was, at the account of the experiences, not to mention antics, of our good, but inexperienced friend who, under the pen-name of " Cadet," gave an account of same in recent numbers of this journal. His story was typical of the many I have read in my private correspondence, and the illustrations were the cat's whiskers; but it was one of those same illustrations which prompts the following solemn warning. At the bottom of page 229, in the issue of March 4th last, he is depicted as driving a completed *Tich* around a very small-radius circle, with his two children as passengers. The kiddies are riding on cars with footboards, but our worthy friend apparently isn't, and judging from his attitude he is having a job to keep his balance. That's just the reason for the following warning—*never, under any circumstances, ride " straddle " on a car without footboards, or a footrest of some kind, even if only an iron stirrup.* Readers of these notes who understand the construction of the " human locomotive," won't need telling why ; but for those who don't, I might inform them, without going into physiological details (that sounds posh !) that without any foot support, the whole weight of the body comes on a small portion of a very vulnerable part of the anatomy. If the car should lurch, or the rider thinks for some reason, that he is going to slip, he will make an involuntary movement that might result in serious injury.

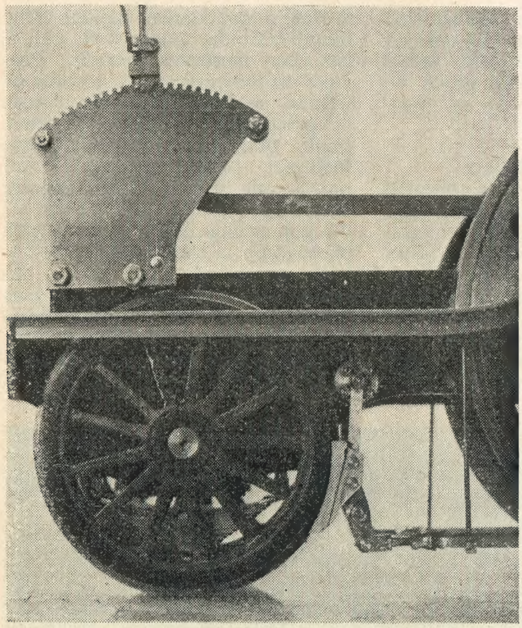
This is no idle warning; I know of several cases which have actually happened. Personally, I have no use for footrests, as I ride like a Victorian horsewoman, the only way I can ride a flat car in comfort, and I get good support; but the other cars which I keep for the few personal friends who visit me on certain occasions, are provided with footboards, as I wouldn't let them run any risk. If they wish to use my little driving car, which has valances to keep my coat from catch- the ends of the sleepers, they have to ride it in the same way as I do. Incidentally, in the sketch, it is the little girl who is showing the biggest slice of intelligence; she is not only resting her feet, but holding on to dad as well. Her brother's feet would hardly reach the footboards, but he is making sure of being safe by hanging on to his sister. It's dad who is running the risk ! May I give him a friendly tip; I hope that he puts the boiler of his *Tich* a little more on the centre-line, as it reminds me of the famous Southern *Leader*, which had an offset boiler, and was a complete failure. Also, to put in a much larger radius, and give the engine a chance to run without grinding the wheel-flanges away—judging by the sketch, there is room enough in the garden !

Changing the subject for a minute, I wonder why he didn't save money, time, and incidentally tea, by wiring up his workshop himself. It would have been very good experience, and a much easier job than building a *Tich*, for a start. I never found anything difficult about the job, and I've done plenty. When a small kiddy, I fitted up an electric bell on the top landing of the house where we were living. Granny lived on the top floor, and she couldn't hear a knock at the front door, if the room door was closed; so young Curly came to the rescue. Granny paid for the materials; the bell cost 1s. 6d., two Leclanche cells 9d. each, and a shilling for wire and staples. I made a metal push " all by myself " ; and oh boy ! *Was* I proud of it ! I'll bet that Thomas Alva Edison wasn't any prouder when his first talking-machine answered him back. The job took me every evening for a week, after school-hours. There was a shelf on the landing, by the room door, which was just right for the batteries, and I hung the bell just underneath them, and tried it. Granny said she could hear it fine, with the room door shut, so I ran my wires down the skirting-board by the stairs—tell it not in Gath, but I could nearly hide the wires in the moulding, and staples were easily knocked into wood ! When I was stooping, my long curls fell over my shoulders and got tangled with the wire, so Granny tied them back in a bunch, and the job was duly finished without mishap, except for a bruised finger, which I hit when a staple slipped. The bell worked fine, and proved a great convenience.

Being naturally inquisitive, I found out quite a lot about" Milly Amp " ; and when one foggy morning in December 1899, Driver Ted Herriott with 388 *Emsworth* on the 8.10 a.m. London Bridge to Oxted, missed a signal at danger, and ran into the back of the 8.7 a.m. South London line train at South Bermondsey, I thought it was about time that

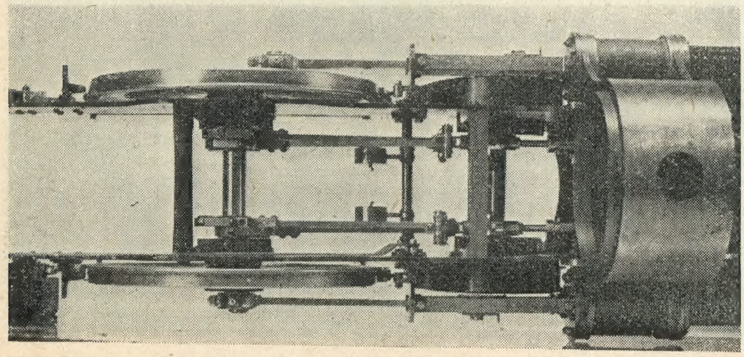


" Little Pat" starts to grow



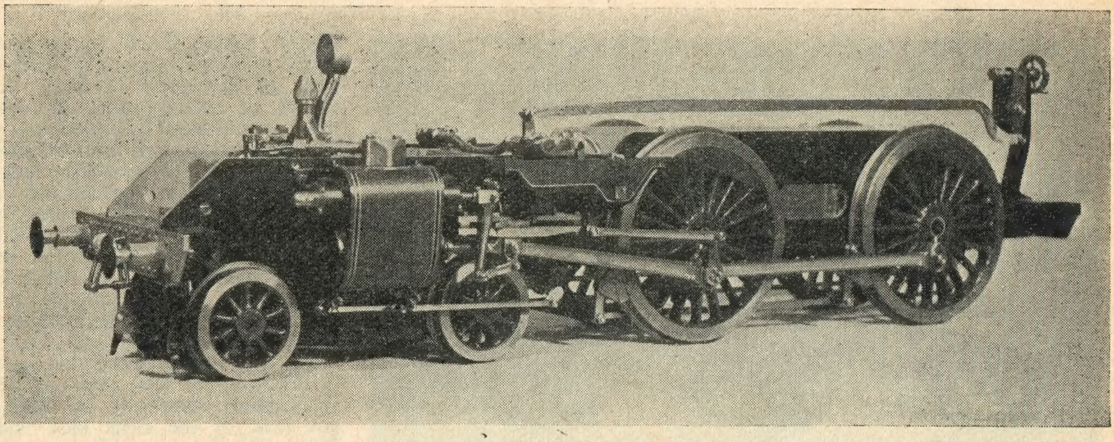
Plenty of scope for notching-up !

Below—Plan of the Stirling link motion



wayside signals should be repeated in the cab, right under the driver's nose, so that there would be no chance of missing them. I fitted up a simple electric repeater on a child's toy clockwork train set, and proudly showed my immediate boss. Alas for my hopes—he said that in view of the very small number of fog accidents, the directors would certainly not go to the expense of having the line and locomotives fitted with cab signalling, and advised me to destroy the fitted toy, and keep my idea to myself. Crest-fallen, I took his advice; but such is the irony of fate, that over 30 years after, somebody in U.S.A. got hold of the same idea, and " cashed in " on it, with the result that cab signalling is quite common on the other side of the big pond.

However, to return to the wiring business, when I first moved to Norbury, I installed a miniature power station, consisting of a small gas engine (which I converted to run on paraffin and water) a 750-watt dynamo, and a set of train-lighting cells. I did all the wiring in connection with this, and it operated successfully, and very cheaply, for sixteen years. When in charge of the munition shop, during the latter part of the Kaiser's war, I did all the wiring needed for installing two additional 3-h.p. motors, and a considerable amount of lighting, all of which passed the insurance and electricity inspectors. The whole of the " extra " wiring at my present home, is—as the pavement artist says—" all my own work "; workshop, garage, outside lights, track circuits for the automatic signalling, and so on. I'm not claiming, for one moment, that all of it is equal to what one might call ultra-professional finish; but I do claim that it is serviceable, and 100 per cent. safe and sound. Anybody with the average amount of gumption, could do the job in similar fashion, and save all the expense incurred by our L-card friend. I'll bet a thousand dollars to a pinch of snuff, that he has no intention of employing a plumber to make the joints in *Tich's* steam and water pipes ! Fuseboxes, main and local switches, power plugs, lamp-holders, lead-covered cable, flex, flu-tube fittings, and all the rest of the blobs and gadgets are readily obtainable; and I'm jolly certain that every reader of these notes could muster up sufficient skill and gumption to make a successful installation, if he so desires.

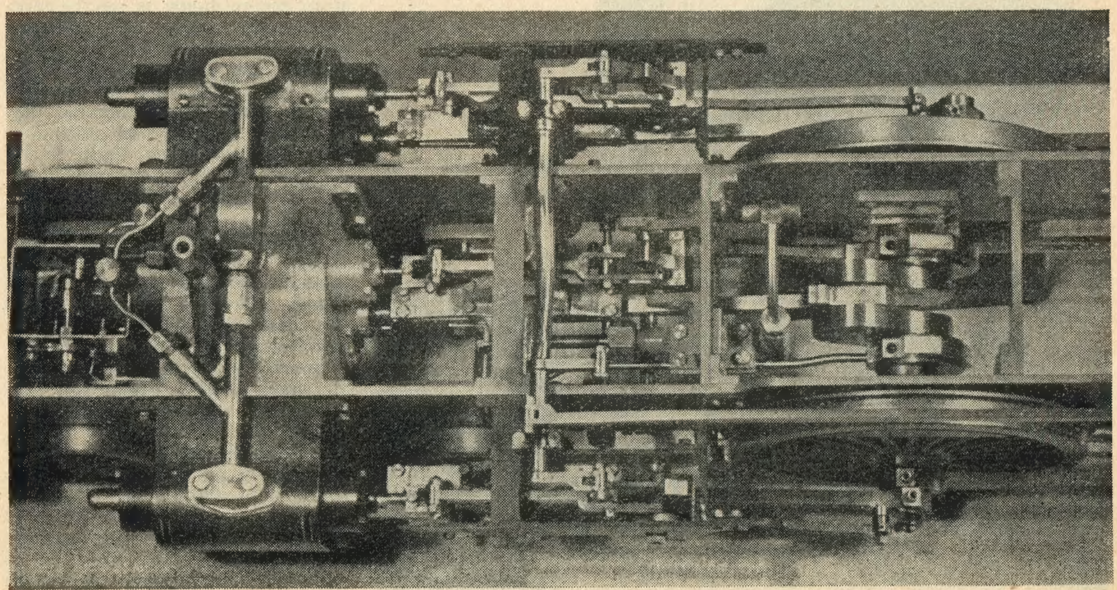


A 3½-in. gauge " Schools " being built by Mr. R. P. Holdstock

Maybe somebody will ask, why not a few " 'ints and tipses ? " That isn't my pigeon, but something for our friend the K.B.P. to decide. In any case, I shouldn't write them, as I've quite enough to do with describing how to build locomotives; and I also don't believe in butting into other writers' subjects in that way. Many correspondents have asked me to describe how to build an electric locomotive, electric multiple-unit motor coach, diesel-electric shunting engine, and various other things, in my own pet style; but I wouldn't do it, for the above reason. The odd notes which have appeared, such as the chime clock repair, the simple crane for the kiddies, the automatic signalling on my railway, and the dissertations about lathes and equipment, do not poach on anybody's preserves, so my conscience is quite clear !

Locomotives in the Making

Some time ago, there appeared in these notes a description and photographs of a super-*Tich* built by an old friend whom I call " Bro. Pimples " for obvious reasons. Well, he's still at it, and going strong, too, as the reproduced photographs will demonstrate, the engine in hand at the present time being a Great Northern 8 ft. single-wheeler of Pat Stirling's well-known design. Our friend built the tender first, and it has been illustrated already. Progress on the engine part, to time of writing, is shown here; the chassis is practically complete. I don't think that our old nighthorse Inspector Meticulous could find much fault with it. For example, take a good look at the big-end of the connecting-rod in the enlarged photograph of the driving wheel; it is the absolute berries. So are the brake hangers—note the set-screws which prevent the blocks rubbing when the brake is off—but Bro. Pimples says, don't look at the chatter marks on the wheel flange !



Mr. Holdstock made a grand job of this little lot !

Bless his heart, he needn't worry, they won't be there long when the engine gets to work on the road. She is being built for WORK, at that; not for show, as our worthy friend doesn't believe in "glass-case ornaments."

Like the late and very much lamented Dr. Bradbury Winter, our friend made his small bright angle-steel by milling it out of a piece of square section of requisite size; I had to do the same, for the weeny angle on top of *Jeanie Deans's* cab. He says it wanted some wangling, to get the proper radius bends over the big-end, and well I know it, too, having "had some" myself. Anyway, it's done, and riveted to the running-boards in correct fashion. You can see the pimples in the side view showing the cylinders. By the way, I wish to goodness that sundry people wouldn't persist in getting me wrong about the pimple business. Provided that the locomotive is built to do the job for which all full-sized locomotives are intended, viz.: pull a train, or its small-size equivalent of a load of living passengers, then its builder is fully entitled to cover it with pimples, and small copies of every blob and gadget to be found on a full-sized engine, *and I have nothing but admiration for his patience and skill.* The person whom I detest, is the one who puts the before-mentioned pimples, blobs and gadgets on a pseudo-locomotive which is a complete washout as far as "going" is concerned (I know of two or three which have never been in steam) and then has the effrontery to deride the builder of a "plain Jane" which will steam like a witch and pull huge loads of passengers, with no trouble at all, "till the cows come home." My good friend Dr. Winter told me, on the last occasion that he visited me in company with his life-long friend Dr. Hovenden, that when he finally finished the "works" of his L.B. & S.C.R. *Como*, he fixed up a temporary boiler and tried them under steam. As was only to be expected, they worked perfectly, and would notch right up nearly to middle, with perfectly even beats. He said that if there had been the least fault, he would have spared no pains to correct it. It's a thousand pities that others do not follow such a good example!

Returning to the G.N.R. eight-footer, the reversing lever is a work of art, and has nine notches each side of middle position, giving almost the equivalent of a screw adjustment of the valve-gear. The latter, shown in the plan view, has hardened steel pins and eyes. The pins are fully-floating, and are kept in place with a collar and split-pin at each end. Working leaf springs are fitted throughout. The boiler is now in hand, and I hope, ere many moons are past, to see the engine run a trial on my road, and offer personal congratulations to her painstaking and skilful builder.

Another correspondent who takes infinite pains to do the job as it should be done, is Mr. R. P. Holdstock, whose *Rainhill* was recently illustrated. Here you can see the job that he has in hand at the present time, a $3\frac{1}{2}$-in. gauge Southern "Schools" locomotive, built to your humble servant's specifications. "Good wine needs no bush," says the old saw; and the photographs show the excellent job that our friend is making of the engine, without any need for detailed explanation. It requires great concentration, and a vast amount of patience and perseverance, to get all the details of a three or four-cylinder engine right—I know that only too well!—but the job is worth the trouble. Note the correctly-shaped crank axle, the separate set of valve-gear for the inside cylinder, and the crosshead pump. The full-sized engines originally had air pumps for maintaining the vacuum when running, same as the Great Western and other engines; and in my specification, I included the pump, but arranged it as a boiler feed pump. One side of the T-piece on the outlet pipe will be connected to the boiler clack, and the other to the by-pass valve. As the ram is connected directly to the crosshead, an eccentric drive is dispensed with, and friction practically non-existent.

At the time he sent the photographs, our worthy friend had no facilities for brazing up the boiler, as specified in my instructions; and as he didn't want to put the brazing out, but wished to complete the job himself, asked if a "rivet-and-solder" boiler could be used, giving an outline of the way in which he proposed to build it. Well, a "rivet-and-solder" boiler is better than no boiler at all, but it would be a pity to spoil such an excellent piece of work by putting an inferior boiler on it.

Nothing Doing!

During the past month I have received three requests from overseas readers, to get them a reliable used locomotive. I wouldn't take on that commission for all the tea in China!

For the BOOKSHELF

The Modern Diesel (Twelfth Edition), by Donald H. Smith, M.I.Mech.E. (London: Iliffe & Sons Ltd.). 256 pages, $5\frac{1}{2}$ in. by $8\frac{3}{4}$ in. 210 illustrations in line and half-tone. Price 12s. 6d. net.

Originally published over 20 years ago, the successive editions of this book have kept pace with the rapid development of the oil engine for transport, marine and stationary use. The present edition is the largest yet published, and deals with the widest range of engines in all spheres, also discussing the latest types of fuel injection systems, combustion chamber design, fuels and lubricants. New developments, such as the application of the diesel engine to private cars, tractors, and light railcars, also small-power air-cooled diesels, are fully described, and specifications given of over 70 different makes of engines, from 11 countries.

Clock Cleaning and Repairing. Edited by Bernard E. Jones. (London: Cassell & Co. Ltd.). 176 pages, 5 in. by $7\frac{1}{4}$ in. 94 illustrations in line and half-tone. Price 4s. 6d. net.

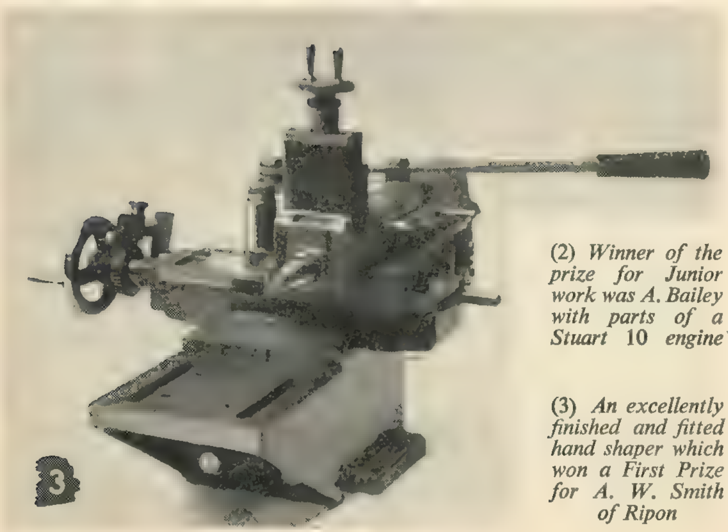
This practical handbook describes in simple terms the servicing and repairing of all types of domestic clocks, from the simple spring-driven alarm or weight-driven wall clock, to the most elaborate striking and chiming clocks, regulators, etc. Chapters are devoted to various types of escapements, both pendulum and balance-spring controlled, also compensating devices, synchronous and impulse-driven electric clocks, and the tools and materials used for clock repairs.

The Leeds Exhibition

Reported by "Northerner"

(1) *F. Cook exhibited this excellent sailing model, 33-in. long overall, of a Whitby fishing smack*

(2) *Winner of the prize for Junior work was A. Bailey with parts of a Stuart* 10 *engine*



(3) *An excellently finished and fitted hand shaper which won a First Prize for A. W. Smith of Ripon*

IN the workshop equipment at Leeds, the prize-winner was A. W. Smith of Ripon, with a hand-shaper built from Cowell castings. This was a very nice tool indeed; in both machining and painting Mr. Smith had achieved an excellent finish, and on the "hand-finished" parts a beautiful surface had been obtained.

Nor was the "spit-and-polish" purely superficial; the slides were well-fitted, with no tight spots but no sloppiness, due to careful scraping. The feed-screw was fitted with a micrometer collar, and the swivelling tool-head was set off in degrees; in both cases the dividing and graduation were very neatly done.

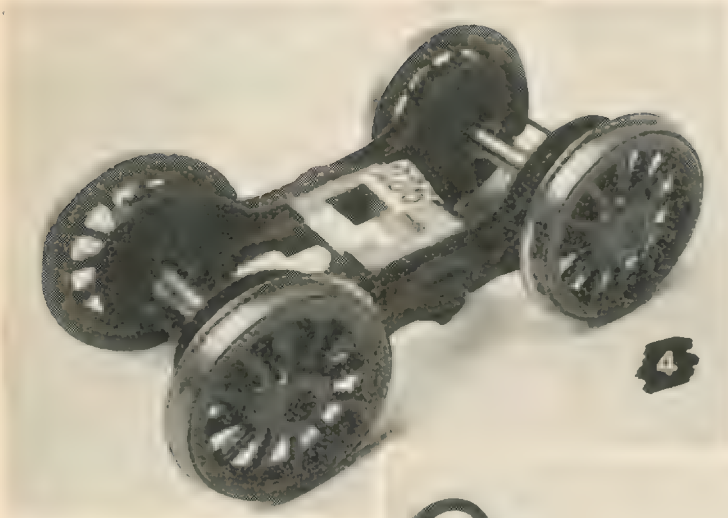
Cross-traverse was by hand-wheel, with the usual automatic ratchet-drive, reversible and with adjustable feed. In all this the finish was irreproachable.

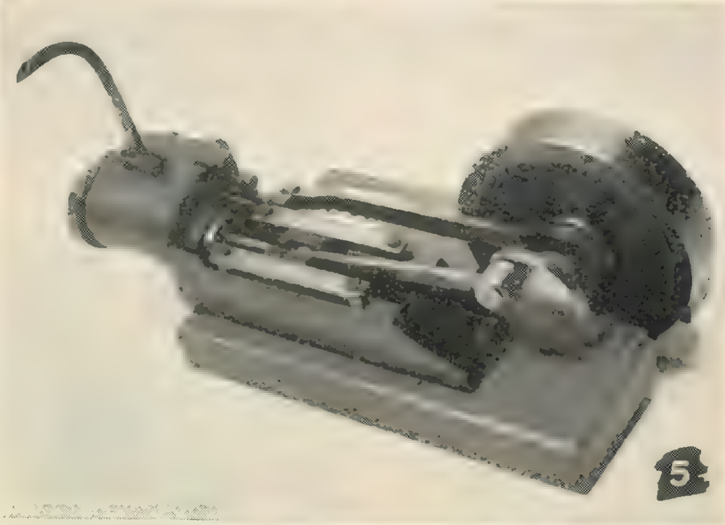
The same remarks apply to a four-wheeled bogie for a N.E. "R.1" class locomotive which Mr. Smith is building. The bogie is fitted with compensated leaf springing, and if the rest of the locomotive is detailed and finished to the same high standards as Mr. Smith has already displayed, it will be a beauty indeed.

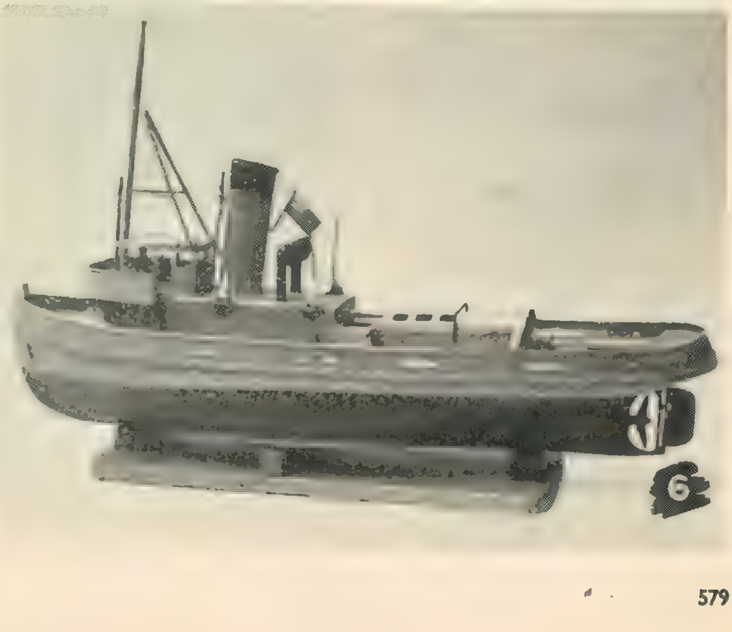
Junior Work

Some beautifully finished toolmaking was displayed by apprentices of the Royal Ordnance Factory at Barnbow, with marking-out tools, small jacks for machine-packing, a highly polished two-speed breast-drill, and so on. These lads were

Continued from page 559, *May* 20, 1954.







(4) *This bogie, also built by A. W. Smith, was beautifully finished*

(5) *Another junior exhibit was this horizontal steam engine by L. Jackson*

(6) *The builder of this unfinished 3-ft. model steam tug, G. Green, served three years in the prototype*

also demonstrating a well-detailed model of a Centurion tank. This was electrically propelled, and fitted with rotating gun-turret; it was run to-and-fro on an undulating surface to show the action of the tracks.

The prize for junior work was won by A. Bailey, aged 16, who is a member of the Model Making Circle held at the Leeds Central High School, under the direction of Mr. J. H. Hainsworth. Bailey's exhibit consisted of parts of an unfinished Stuart 10 vertical engine, which all bore evidence of painstaking workmanship,—for example, when one tried the piston in the bore, the latter was dead parallel.

There were one or two departures from standard design in the engine; the main bearings had been split, and the piston rod was turned solid with the piston, into which two rings were fitted.

Another steam-engine built by a 16-year old was that of L. Jackson, who had made his own patterns for cylinder and valve-chest, from which castings had been obtained locally. The bedplate was bent up from sheet-metal, and the bearings had been cut from the solid, giving a strictly " utility " appearance to the engine. The standard of craftsmanship was lower than on the Stuart engine—young Jackson must learn to remove file-scratches and not to be careless with his paint-brush—but if these two youngsters persevere, they should do very well indeed as their work matures.

Marine Models

Among the marine models were some I have reported on previous occasions, including the prize-winner, A. Whiteley, whose *Walton Thames* A.S.R.L. was illustrated on page 701 of the last MODEL ENGINEER volume. Another was the 1/10th in. scale cargo-boat by C. Ledwidge of Huddersfield, mentioned on p. 114 of the same volume.

However, I hadn't seen previously the model of a Whitby fishing smack

(*Continued on page* 583)

MORE UTILITY STEAM ENGINES

Boiler Design and Construction

By Edgar T. Westbury

IN the two previous articles under this heading, little has been said on the subject of circulation, though this undoubtedly has a very important bearing on boiler design and efficiency. Generally speaking, it is not necessary to worry a great deal about this factor in boilers which contain a considerable amount of water in relation to the rate at which water is evaporated, but as the internal capacity of the boiler is reduced and its rate of steam generation increased, circulation assumes more and more importance.

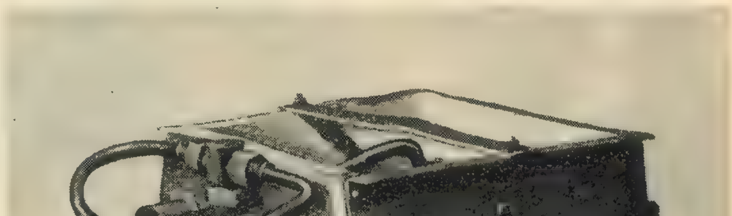
A simple pot boiler, or even a domestic kettle, in which no provision for ordered circulation of the water therein is arranged, will produce steam quite satisfactorily at a relatively low rate, but if any attempt is made to increase its efficiency by applying more heat, the disordered movement of the water will result in difficulty in separating it from the steam which is taken away. Even when baffles or other devices are fitted inside the steam space, it will not be easy to obtain dry steam, and at worst, violent " priming " will take place, with risk of mechanical damage to the engine. This fixes a definite limit to the rate at which the particular boiler can produce steam, whatever method of firing is employed.

In the boilers so far described in this series, only moderate steam generating rates are aimed at, and the amount of water contained in them is large in relation to the amount of steam they are required to produce. In consequence, circulation does not present any very serious problems. The vertical test boiler, however, has a fairly good circulation system, as the water in the tubes has a well-ordered " one-way traffic " route, and can pass freely upwards, to be replaced by water passing downwards in the region of the outer shell, which is relatively cool. In the internal-flue horizontal boilers, conditions are not quite so straightforward, as there is no definite segregation of conflicting water currents, but in common with most boilers of this type, the water in the region of the flues moves upwards, and that near the shell moves downwards. The fitting of cross water tubes in the furnace flues assists greatly in this respect. (This matter was dealt with in some detail in the first series of articles on " Utility Steam Engines.")

Water-tube Boilers

It may be said that almost any type of boiler having internal flues or fire tubes has definite limitations for fast steaming, because of circulation difficulties, and although such boilers can be improved in detail design, or by the fitting of circulation augmentors (which artificially influence the direction of currents by the use of steam or water jets), they cannot cope with the requirements when it is necessary to obtain the utmost power from light and compact steam plants. This fact has long been recognised in all branches of full-size steam practice, with the possible exception of locomotives, where the conventional type of boiler is the only one which can readily be applied to this particular installation. In other branches, including marine and stationary plants, the water-tube boiler has almost completely superseded the Scotch and other internal-flue or fire-tube types, notwithstanding their many solid virtues which enabled them to hold their own for many years against all comers.

A classic test, which established



A model Yarrow type boiler made years ago by a member of the Glasgow S.M.E.

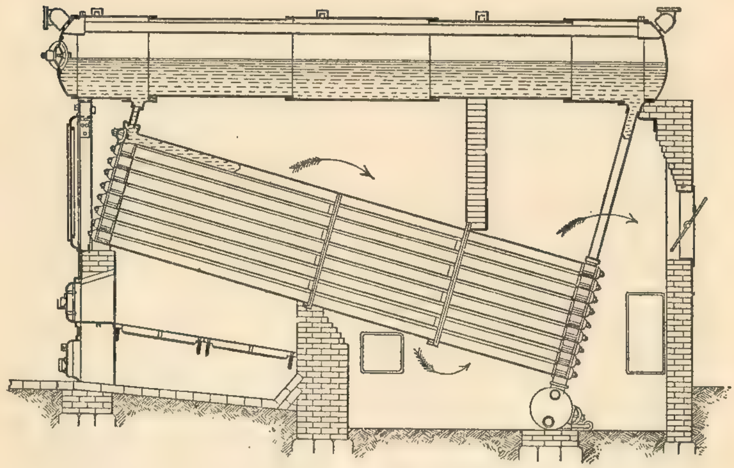
Continued from page 524, *May* 13, 1954.

definitely the superiority of the water-tube boiler for fast ships, was made by the British Navy at the end of last century, when careful comparisons were made between the performance of ships equipped with Scotch marine boilers, and water-tube boilers, respectively. I have not been able to obtain an authentic account of these tests, but it appears that despite the fact that the particular water-tube boilers gave a good deal of trouble due to faults in construction, their ability to generate steam at a much faster rate than the Scotch boiler, in conjunction with their much lighter weight, decided the policy of the Navy to adopt water-tube boilers for all fast ships.

Perhaps I should apologise to readers for taking up space in discussing full-size boilers, especially because there is much in them which cannot be scaled down successfully, but I think that so far as basic theory is concerned, we can learn a great deal by a general study of their design. I am a great believer in getting down to sound basic theory—but in case there should be some confusion over the term, this does not mean the same thing as running amok with a load of mathematical formulae, as some readers seem to believe. Mathematics is an exact science, for which I have every respect—in its proper place; but in the attempt to apply it to very inexact sciences, its exponents often have recourse to "assumptions"—little more than jumps in the dark—which may lead them anywhere but to the correct answer. And because they have used exact methods in working out the problem, they cannot see how the result could possibly be wrong! Sound theory is just plain, commonsense reasoning in finding out what makes things work or how to make them work better, and may not necessarily involve the use of figures at all.

Design of Water-tube Boilers

One of the first water-tube boilers to be used in the British Navy was the Belleville, of French design, though this had a rather short career, as it was the subject of an unfavourable official report in 1902, and now appears to be entirely extinct. I am, however, inclined to think that the difficulty of sound construction, in what was then an entirely new and complicated form of boiler, may have caused these boilers to leak or produce other maintenance troubles, not necessarily connected with the design as such.



An early Babcock land installation, of the longitudinal drum type

The generating elements of this boiler were composed of banks of straight tubes, inclined at an angle of about 1 in 25 to the horizontal, and socketed at each end into junction boxes similar to the end of a spearhead superheater, so as to connect the tubes in series, each bank thus forming in effect a flattened helical coil standing on end. Water was admitted to the lower end of each element, and discharged at the top into a horizontal drum. Continuous circulation was maintained by leading the cooler water from the ends of the drum, through "downcomers," to a horizontal gallery connecting with the lower ends of the elements.

The complete system was superimposed on a furnace lined with firebrick, and in the uptake, a miniature system of similar tubular elements was fitted, through which the feed water was pumped before being admitted to the generating tubes. (Similar feed water heaters are of course used on many other boilers, whether of the water-tube type or otherwise).

It will thus be seen that the general pattern of design was that which has become established for most subsequent types of water-tube boilers, large and small; namely, generating tubes disposed so as to produce an upward convection flow, a collecting vessel in which the steam may be separated from the water, and passages, not designed to act as steam generators, which lead the unevaporated water back to the lower end of the generator tubes. Thus a complete unidirectional flow is established, which enables the maximum rate of circulation to be maintained, in proportion to the heat applied. Nearly all water-tube boilers have external furnaces, which potentially might be considered as capable of wasting heat, but they can be fairly effectively insulated, and in some cases "water walls" have been used to conserve heat which might otherwise be wasted, and turn it to useful purpose by acting as an "economiser" or feed water heater.

The Yarrow Boiler

Another water-tube boiler much more extensively employed in ships, was the Yarrow type, which has already been discussed in the first series of articles, and is so well known as to call for only the briefest description here. Its characteristic feature was the use of three drums, arranged in the form of a triangle, with the largest at the apex, serving as a steam drum, and the other two at the base, acting as water drums, but more commonly termed "mud drums," as they collected any solid residue contained in the water. The base of the triangle was utilised as the grate of the furnace, and the sides were occupied by banks of water tubes connecting the upper and lower drums. Outside the generating space, but usually lagged to avoid unnecessary loss of heat, were the "downcomers" of large diameter which led the water from the ends of the steam drum to the two lower drums. The pattern of circulation is thus quite straightforward, and the straight, steeply-inclined generating tubes offer much less obstruction to convection

currents than the tortuous low-gradient passage through the tubes of the Belleville boiler.

It is well known that the design of the Yarrow boiler was the result of long and patient practical research by the designer, most of it being carried out with the aid of working models; and for this reason, if no other, it deserves serious consideration by model engineers. Many model boilers have been built embodying the general arrangement of the Yarrow boiler, and have been fairly successful, though it is obviously impossible to build them exactly to scale, as the minimum size of the generating tubes, and their number, are limited by practical considerations. Some of the boilers alleged to be of Yarrow type which I have seen have not been fitted with downcomers, and thus the whole point of the design would seem to be missed; but they work better than one might expect, probably because the generating tubes are not all equally heated, and some of them serve the purpose of downcomers.

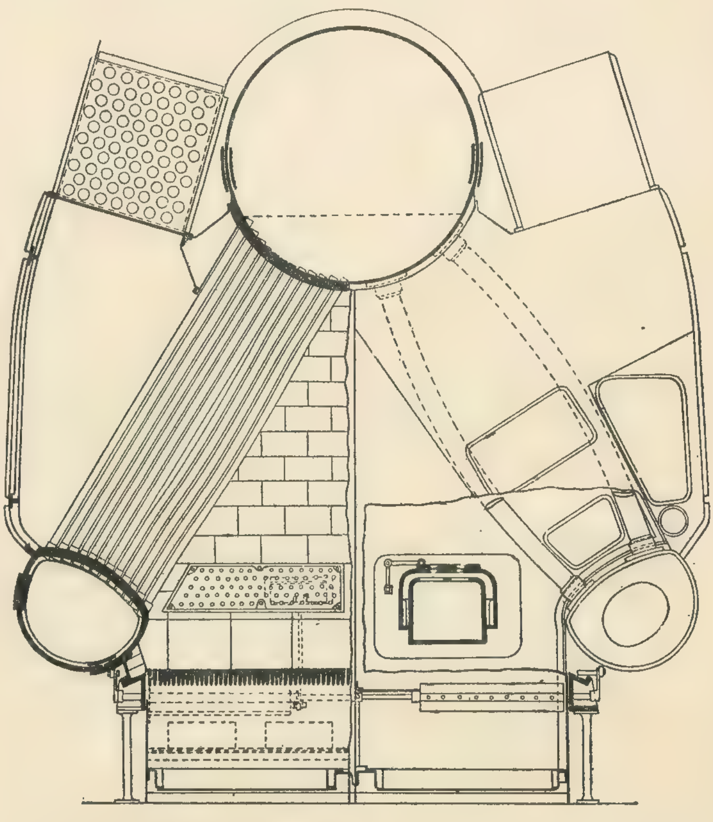
There have been several variants of the Yarrow boiler in full-size practice, such as the Thorneycroft and White-Forster types, which have been used a good deal in naval pinnaces; they differ mainly in using bent generating tubes in place of the straight ones of the Yarrow, to obtain greater heating surface area and utilise more effectively the available boiler space. The Stirling boiler, which is much used in land installations, but hardly ever, so far as I am aware, in marine work, might be described as similar in arrangement to a Yarrow, but usually the steam drums are smaller, and in triplicate, each with its bank of tubes, connected to one or more lower drums.

The Babcock Boiler

The original form of this boiler, which was used for land installations only, had a long steam drum arranged end-on to the furnace, and communicating at each end with headers connecting a bank of tubes inclined at an angle of about 15 deg. to the horizontal. The grate of the furnace was under the higher end of the tubes, and extended less than half their length, but by means of baffles which caused the combustion gases to pass across the bank of tubes three times, their whole length was effectively utilised, and as the temperature of the gases was lowered in its tortuous passage, the rear header acted as a downcomer. This type of boiler had fairly large tubes, about 4½ in. diameter, but in the marine type evolved later, the size of the tubes was reduced to 1¾ in. diameter.

The latter type was also rearranged to afford greater compactness, the steam drum being shorter, and disposed across the furnace; the tubes still ran fore-and-aft, but the front end was the lower, and the rear header communicated with the steam drum by large horizontal tubes well above the normal water level. This type, with minor variations and improvements, is now extensively used on land and sea. Few working models of the Babcock boiler have been built, so far as I know, and the more complicated form of construction is probably a deterrent to model engineers, but I saw a very good model, albeit a bit too large for most model requirements, at the Bedford "M.E." Exhibition a year or two ago.

I have had experience not only with Scotch boilers, but also with Yarrow and Babcock boilers in ships; both the latter were excellent steamers, and could be forced to the limit of what we could pile on in the way of fuel and forced draught, whether burning coal, oil fuel, or a combination of the two, as in H.M.S. *New Zealand* at the Battle of Jutland, where the ship was called upon to produce a speed far in excess of that for which she had been designed and tested. The point which stands out strongly in my mind was the different treatment called for in the respective types in cleaning and maintenance. In the Yarrow, it was only necessary to remove three manhole doors to get inside the drums for internal cleaning, but access to the internal tubes, and application of the "searchers" or wire brushes, was more difficult. The tubes of the Babcock boilers could be effectively scoured by straight brushes—but oh! those thousands of hand-hole doors in the headers, each needing an asbestos gasket, and the utmost care in fitting! The Yarrow boilers were also easier to clean on the furnace side, and there was a particularly nasty spot in the Babcock boilers, between the generating bank and the



A typical full-size Yarrow boiler. (This example is fitted with air heaters at the sides of the steam drum)

horizontal tubes, which we called the "pigeon-hole," and in which the cleaner had little room to move. Both boilers demanded a constant watchful eye on the gauge glasses, as failure of feed would call for instant emergency measures, but we had the trusty Weir pumps, which never gave us a monent's trouble.

Stoking

The stoking of water-tube boilers —in the days when coal was used—was a very exacting business, and light, frequently replenished fires were necessary, in contrast to the Scotch boilers, in which one could pile on the coal and then take a breather. There was a much-hated device known as a Kinghorn regulator, which rang a bell at intervals controlled by the engine room, and showed a number to indicate the furnace to be fired with "not more than four shovelfuls." At full speed, this kept the stokers running non-stop from one furnace to another; brawny stokers who boasted of having steamed the toughest tramps throughout the seven seas were worn to a shadow by this method of firing. It was also necessary to lay the coal evenly, otherwise the draught would blow a hole in the fire, which would soon lower the steam pressure, and was difficult to fill in again. Clinkering demanded frequent use of a heavy "slice" bar which took two men to handle. All this, of course—not to mention the further delights of "coaling ship"—was eliminated when oil fuel replaced coal, and the heaviest tool the stoker had to wield was a wheel-spanner! Forgive the reminiscences, dear readers, which have little to do with model engineering, but will nevertheless, I hope, be of interest, even if they only show the difference in the management of large and small boilers.

Heating Surface

Apart from enabling the water to be circulated rapidly, water-tube boilers have the advantage of enabling a larger area of heating surface to be employed, in a boiler of a given total bulk, than fire-tube or internal-flue boilers of orthodox design; this is especially true in the small and simplified boilers with which we are principally concerned. Take, for instance, the comparison between two popular types often used in model power boats, namely, a centre-flue boiler with four to six cross water tubes, and a "Smithies" type water-tube boiler, in other words, a plain cylindrical drum with three or four bent water tubes on the underside. I do not propose to quote actual figures of the respective heating surface areas, which may vary widely in individual cases, but a little consideration will show that the surface of the inside flue, plus that of the short cross tubes, in the former case, is very meagre. In the latter boiler, assuming that it is enclosed in the usual internally-lagged casing, the entire external surface of the drum, plus that of the water tubes, is to some extent effective as heating surface.

"Effective" Heating Surface

A word of caution, however, is called for when one starts measuring up the area of heating surface in boilers; always remember that the operative word is "effective." The fallacy of cramming in a close or tortuous formation of tubes, in order to make up a large total area of heating surface, has been exposed on many occasions, and formulae based on this principle, though often quoted, are notoriously unreliable in assessing boiler efficiency. One cannot safely assume that the heat will reach all parts of the surface provided, or that the temperature in all regions will be equally high; further, the close packing of tubes may impede the flow either of water or combustion gases, and thereby actually lower the heat transmission efficiency.

The design of the furnace, and the method of firing, also influence the way in which heating surface can be utilised. As I have often pointed out, many water-tube boilers fail to give the results expected, or of which they should be capable, simply because they are not fired efficiently. Generally speaking, such boilers demand a method of firing which produces a large volume of flame, or large area of radiant heat surface, rather than the long and narrow high-intensity flame which is most effective in the restricted space available in a centre-flue boiler. I shall have something to say about burners at a later stage, and I hope to be able to give one or more designs of suitable types for both internal-flue and water-tube boilers.

Perhaps it may be considered that I am rather exaggerating the problems of boiler design, and making it appear more difficult to produce steam for small engines than it really is. Hundreds of model engineers are using boilers and burners having features which are very much open to criticism, but are perfectly satisfied with the results they obtain from them. It is all a question of the standard of efficiency to which one aspires, and my aim is to show readers how this may be raised; I do not "condemn" anything that produces the desired results, though I am often accused of doing so. But many readers of the first series of articles on "Utility Steam Engines" have acknowledged the usefulness of the advice and information they contained, and the present series is largely inspired by their requests that it should be carried a stage further.

(To be continued)

THE LEEDS EXHIBITION

(*Continued from page* 579)

built by Frank Cook. This was rather a representative model built for sailing than a super-detail job, but even so it did include plenty of detail, with its coloured sails, box-wood blocks and bowsies, cleats and bollard, fishing-net, and hatch to the fish-hold. The hull was carved from the solid, and it will be seen that the builder has well achieved the unusual shape typical of the port of Whitby.

Mr. Cook also exhibited an East Coast fishing coble of similar description, as well as many other models of various kinds including steam engines and locomotives—one of the latter is a genuine "Carson," by the way.

A further ship-model was the 36-in. steam tug *Sister A*, built by G. Green to drawings of the *Empire Teak*, *Empire Race*, and *Empire Doris*, on which Mr. Green had served for three years. In the model, however, the bridge and funnel have been modified to the peace-time appearance.

The hull appeared to be carved from solid wood, with decks and superstructure of aluminium, flush riveted. The davits and fore-hatch are aluminium castings, but as yet the model is nowhere near completion, and much detail work has still to be made and fitted. I hope to see the finished model at a future Leeds exhibition.

A Model With a Purpose

By E. M. Ackery

THIS model is one of a series illustrating various ways in which electrical power can be used in agriculture and, being somewhat out of the ordinary so far as most models are concerned, a brief description of the original seems desirable.

With the increasing use of combine harvesters in this country; that is, machines that reap and thresh in one operation, there has come a need for the farmer to be able to dry and store his grain; because, as a rule, the grain harvested here has too high a moisture content to permit it being stored without drying. Grain can be stored in a stack with a higher moisture content than when it is threshed and stored in sacks or silos.

The model shows a complete " In Silo " grain drying and handling plant, and comprises the silos for storage, the fan, electric air heater, and ductwork for drying, and the pneumatic grain handling plant.

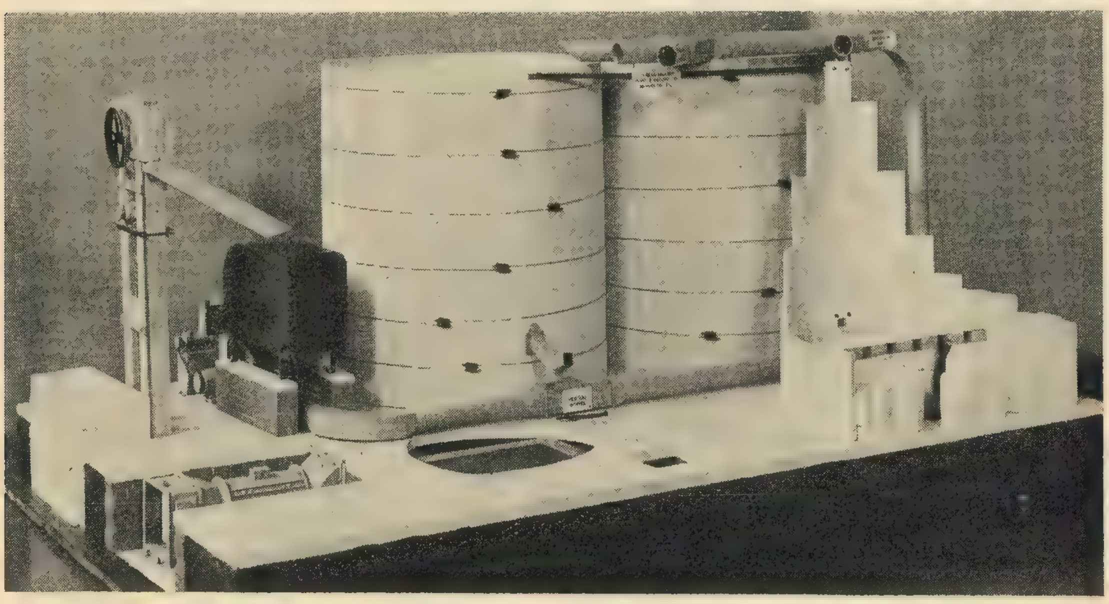
In brief, the grain is winnowed, and discharged into the silos, which have porous false floors, through which warm air is blown.

The plant consists of four silos each 10 ft. diameter by 11 ft. 3 in. high in the real thing, these being constructed of tongued and grooved concrete slabs, held together by straining-rods encircling them. In the model, these are represented by 30 tongued strips of wood, scored, in a universal scoring jig, to indicate the horizontal joints, made up on two circles of plywood, one at the bottom and one a few inches below the top. These circles had to accommodate the 30 strips exactly, and several methods of cutting them were tried before a satisfactory one was discovered. First, a peg was mounted on the fretsaw machine table, the correct radius distance from the saw blade, and the plywood rotated against the saw. Unfortunately, the saw blade wandered, and in addition, the only method of trimming to an exact fit was by hand sanding. Next, a peg was mounted on the circular-saw table and a rough-cut disc rotated to trim it to a true circle. This was better, so long as very little had to be trimmed off, but fine adjustment of the radius was difficult. The final method, which worked like a charm, was to mount a temporary wood table at approximately centre height on the lathe cross-slide, screw in a peg and rotate the rough-cut disc against a sanding disc mounted on the face-plate, the leadscrew giving a delightfully fine feed, enabling minute fractions of an inch of radius to be taken off in a matter of seconds, till the 30 strakes, when offered up, fitted round exactly.

It is interesting to note that the straining-rods had to be provided with lock-nuts as, without them the vibration caused by only a few miles transport in a car was sufficient to slack off the straining-nuts.

The top disc is coated with imitation grain, and here one of the well-known seed growers was most helpful in suggesting and providing a seed, New Zealand Brown Top, that looks quite like oats to a scale of 1 in. to a foot.

Two silos are complete, the third is sectioned to show the construction of the false floor of porous concrete slabs and the warm air plenum chamber underneath to give even distribution of the drying air, whilst the fourth is only indicated by a painted circle, and shows the



General view of " In Silo " grain drying and handling plant

underground duct leading from the aid dryer and fan.

Drying Plant

This consists of a bank of electric air heaters, mounted in front of a twin axial-flow fan, which draws air through the heater battery and blows it into a main underground duct. From this duct, branches lead to the plenum chambers, under the false floor of each silo. In the real thing, there are dampers to shut off the air flow to any silo not in use, but as these are not seen in the model, only the operating levers on the floor over the duct are fitted.

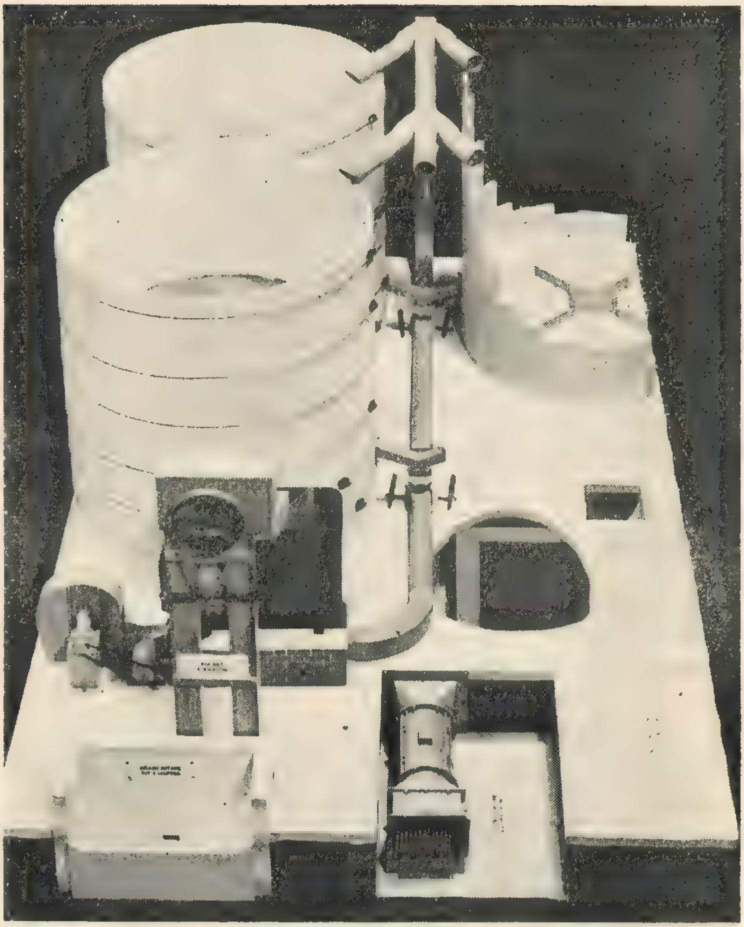
The fan and heater unit is complete and to scale externally; it is made of wood and metal, and calls for no comment, except perhaps so far as the square flanges on the heater battery casing are concerned. To save the trouble and difficulty, to say nothing of the amount of brass sheet required, of making these by cutting a square hole in a square sheet of metal, each flange is made up of two L-shaped pieces, silver-soldered together to make a square. The L-pieces were cut exactly to size, with a fret saw, in a simple cutting jig, and needed no finishing.

Grain Handling Plant

The grain from the field is dumped into a receiving hopper and picked up from there by a bucket-type elevator. The large pulley with curved spokes that is used to reduce the speed of the driving motor was made by drilling holes in a hub and silver-soldering into these the curved spokes, made purposely rather over long. The rim was turned from a gas barrel socket. The hub and spokes were then mounted horizontally on a peg fixed in the grinding machine tool support. This support can be moved nearer to or away from the grinding wheel. The assembly was rotated against the grinding wheel and the distance between peg and wheel adjusted till the spokes were a nice fit inside the rim, when they were sweated in position.

From the top of the elevator, the grain drops by gravity through a chute into the winnower, a fairly simple exercise in sheet metal shaping and soldering. The rounded corners of the side plates were made by adopting a similar procedure to that used for the pulley spokes. An accurate radius is speedily obtained without difficulty.

After winnowing, the grain drops into the grain delivery piping, through a venturi hopper. This piping comes from a high-pressure centrifugal fan and the venturi is arranged, similar to an injector, so that the grain is sucked into the air stream. Once in the piping, the grain is blown along, to be discharged over the top edge of any of the silos.



End view, showing in part section, the air heaters, fan and underground duct

The spiral casing of the centrifugal fan was made in a similar way to the silo discs, but in order to get a spiral, two different radii are used in succession.

At the bottom of each silo is a grain outlet pipe with a closing slide, and these pipes lead into additional venturis in the grain delivery piping, so that grain from any of the silos can be transferred into another silo or taken to a bagging-off point or grinding mill.

The scale of the model is 1 in. to the foot. It is not a working model, but is to scale so far as visible details are concerned. The overall size is 33 in. × 21 in. × 14 in. high. Eggshell synthetic enamel is used on silos and floor: all the other parts being cellulose sprayed in the colours used by the manufacturers of the original machines.

In all, five of these models were made, and they are used by Electricity Boards at agricultural shows. It might be thought that the amount of repetition work in producing five copies would be wearisome, and lead to a loss of interest, but repetition work gives ample scope for ingenuity, in devising methods of quick and accurate construction, and for the making of simple jigs; this in itself gives a most satisfying sense of achievement. There is great interest too, in collecting details of the various machines; during which one can hardly fail to learn something about their construction and operation.

British Railways Standard Class 3 Tender Engines

THE building of the first of the new standard class 3, 2-6-0 tender engines has now been completed at the Swindon Works of the Western Region.

Of the 20 locomotives to be built, ten are to be allocated to the North Eastern Region and ten to the Scottish Region. The engines are numbered 77000 to 77019 and were designed under the direction of Mr. R. A. Riddles, who at the time was the Railway Executive Member for Mechanical and Electrical Engineering. The parent office for design was Swindon but certain details were undertaken at Brighton, Derby and Doncaster.

The tractive effort, 21,490 lb. is the same as that of the class 3, 2-6-2T engines previously built at Swindon. Like the tank version, the tender type has almost universal availability over main and secondary lines throughout Britain, and is designed to replace various tender engines of similar power classification now becoming obsolete.

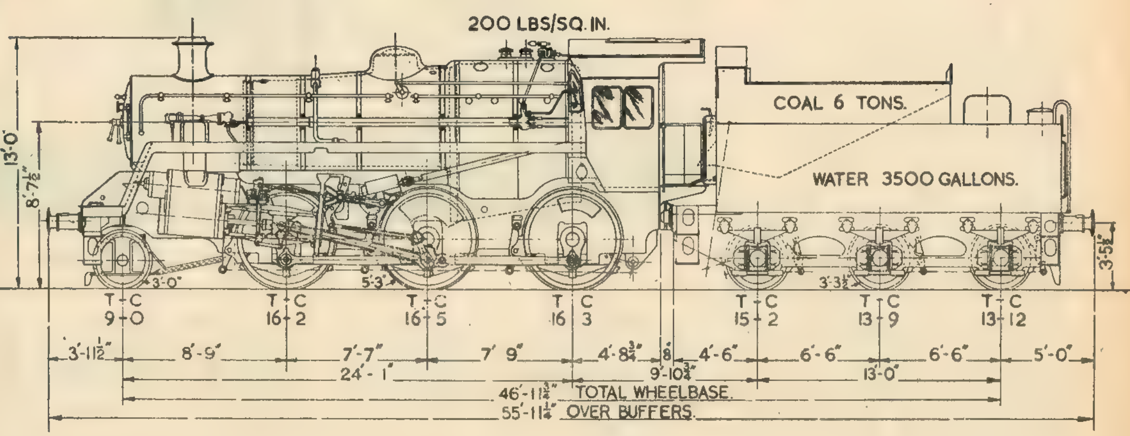
The leading dimensions are shown under the drawing.

Boiler

The boiler, which is the same as that used on the tank version, follows closely the design of the former G.W.R. Standard 2 used on the 5100, 8100 and 5600 classes. The steel and copper flanged plates for the firebox are common to both designs but the barrel is $5\frac{13}{16}$ in. shorter. This consists of two rings, the second of which is tapered, the outside diameter being 4 ft. 5 in. at the front and 5 ft. $0\frac{1}{2}$ in. at the firebox end. Both barrel rings are made from high-tensile steel plate $\frac{1}{2}$ in. thick. The smokebox tubeplate is of the drumhead type $\frac{5}{8}$ in. thick and there are 18 large fire tubes $5\frac{1}{8}$ in. diameter outside 7 S.W.G. thick and 145 small tubes $1\frac{5}{8}$ in. diameter outside 12 S.W.G. thick. The length between tube plates is 10 ft. $10\frac{1}{2}$in.

Firebox

The firebox is of the Belpaire type, 7 ft. long at the bottom, with an outside width of 4 ft., giving a grate area of 20.35 sq. ft. The steel outer wrapper plate and the copper inner wrapper plate are both $\frac{9}{16}$ in. thick. The throat and back plates are vertical, the former being $\frac{5}{8}$ in. thick and the latter $\frac{9}{16}$ in. thick; the copper tube plate is $\frac{7}{8}$ in. thick.

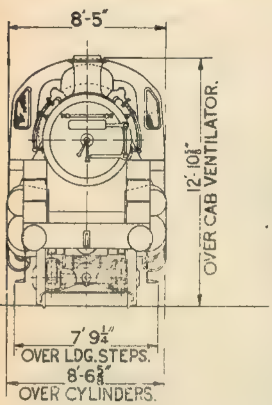


BOILER BARREL DIAMETER (OUTSIDE) — 4'-5" INCREASING TO 5'-0½".
FIREBOX (OUTSIDE) — 7'-0" LONG X 4'-0" WIDE.
TUBES — 18 LARGE 5⅛" O.D. X 7 S.W.G
145 SMALL 1⅝" O.D. X 12 S.W.G.
SUPERHEATER ELEMENTS — 1⅜" O.D. 10 S.W.G.
LENGTH BETWEEN TUBEPLATES — 10'-10½".
HEATING SURFACES TUBES — 932·90 SQ. FT.
FIREBOX — 118·40 " "
TOTAL EVAPORATIVE — 1051·30 " "
SUPERHEATER — 190·00 " "
FREE FLUE AREA — 3·08 " "
GRATE AREA — 20·35 " "

CYLINDERS (TWO) — 17½" X 26".
TRACTIVE EFFORT — 21490 LBS.
ADHESION FACTOR — 5·05
BRAKE % ENGINE & TENDER — 60·7
MINIMUM RADIUS CURVE — 4½ CHAINS
(WITH SPECIFIED GAUGE WIDENING)
BOILER TYPE — BR. 6.
TENDER TYPE — BR. 2 A.

STANDARD CLASS 3. 2-6-0

This photograph shows the general appearance of the standard 2-6-0 mixed-traffic locomotive of Power Class 3. The engines of this class have almost universal availability over main and secondary routes throughout Britain, and will replace various obsolescent tender engines of similar power



WEIGHTS	FULL	EMPTY
	T - C	T - C
ENGINE	57 - 10	53 - 0
TENDER	42 - 3	20 - 10
TOTAL	99 13	73 10

SCALE
0 1 2 3 4 5 6 7 8 9 10

D ENGINE.

All the firebox water space stays are made of monel metal fitted with nuts inside the firebox, while the roof, longitudinal and transverse stays are of steel. The lagging of the boiler and firebox consists of asbestos mattresses.

A rocking grate and self emptying ashpan are fitted, the details wherever possible being the same as those on other standard classes. The boiler mountings, regulator, clack valves, manifold and smokebox details are the same as those on the tank version.

The engine frame, as on previous British Railways standard locomotives, is adequately stayed both horizontally and vertically, whilst the boiler securing arrangement, the spring gear arrangement and the method of staying axlebox guides are similar to those obtaining on other classes.

Interchangeability

The wheel arrangement is the same as on the tank version but without the trailing pony truck. Other similar design features include the axleboxes, axlebox guides, lubrication, cylinder cock and sanding arrangements. The cab layout follows closely the arrangement on the other standard tender engines. The cylinders, of which there are two, are of cast-steel with cast-iron liners and are the same as used for the tank version. Nominal 10 in. diameter valves are provided, the rear heads being ⅛ in. smaller in diameter for ease of insertion and removal. They are operated by a Walschaerts valve gear giving full gear travel of 6.29/32 in. corresponding to a cut-off of 75 per cent. The steam lap is 1½ in. and the lead ¼ in. The whole gear, with the exception of the reversing shaft and screw, is identical with that of the tank version, the reversing screw in this case being similar to that of classes 4, 5, 6 and 7 tender engines.

The leading pony truck is of standard design, the side play being controlled by helical springs.

Tender

The tender is the standard B.R. 2A with 6 tons of coal and 3,500 gallons of water, and although smaller, follows the pattern as used for Classes 6 and 7, 4-6-2 and Class 5, 4-6-0.

Steam brakes are provided on both engine and tender.

The photograph above is reproduced by courtesy of British Railways.

IN THE WORKSHOP
BY DUPLEX

Constructing an Engraving Machine

WHEN operating the machine, the cutter is fed into the work by means of a screw-feed gear; in addition, the depth of engraving is set and also maintained at a uniform level by the action of an adjustable stop mechanism.

As previously described, the upper part of the body of the cutter head is made an accurate sliding-fit in its bracket *De* which, in turn, is attached to the head-link *Dc*.

The head clamp-bracket *Ea* is made in two parts, and these are drawn together by a screw and clamping lever, so that when the screw is tightened, the bracket becomes securely fixed to the body of the cutter head. This bracket also carries the small stop-plate *Eb* that forms part of the depthing mechanism.

Continued from page 530, *May* 13, 1954.

The outer, slotted end of the bracket *Ea* carries the threaded trunnion block *Ec*, and this part engages with the actuating-screw *Ed*. This screw is machined with a two-start Acme thread of $\frac{1}{4}$ in. pitch, so that the lead, corresponding to a single turn of the screw, amounts to $\frac{1}{2}$ in.

At the upper end, the screw is fitted with a fluted, plastic finger-wheel. The screw is bored to a working-fit on the spindle *Ee* and, when in place, is end-located by the 6-B.A. screw shown in the drawing. The spindle is screwed into the upper plate *Df* forming part of the head mounting.

If the bracket *Ea* is now clamped to the cutter head, the head will be raised or lowered as the actuating screw is turned.

Although, when operating the machine, it would be possible to feed in and withdraw the cutter by turning the finger-wheel, more convenient working is obtained if the feed-screw is turned by means of a Bowden wire mechanism, having an operating handle mounted near the tracing table.

The Bowden Control

A collar *Ef* and a cover-plate *Eg* are secured to the upper surface of the finger-wheel, and the clamp-bracket *Eh* is made a working-fit on the collar. The extension lug, bored $\frac{3}{16}$ in. diameter, serves to carry the moving member of the Bowden fitting. In this way, the clamp-

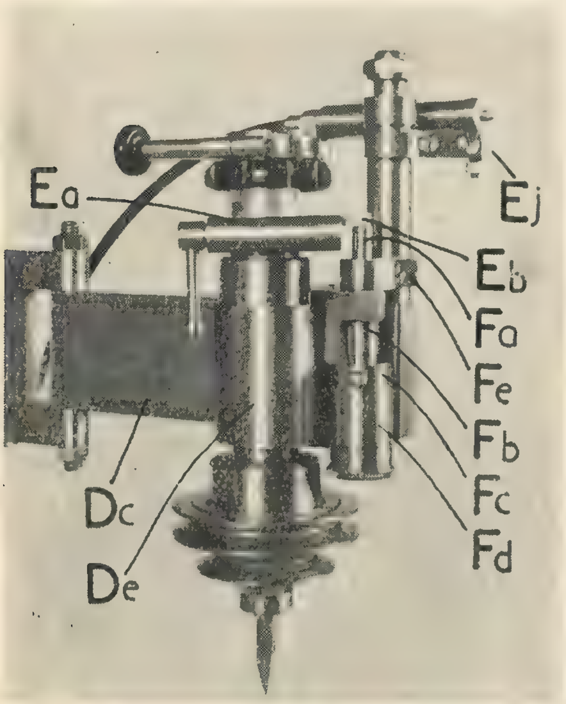


Fig. 38. *Da—the head link-bar ; De—the head bracket ; Ea—the head clamp-bracket ; Eb—the stop-plate ; Ej—the Bowden wire anchor bracket ; Fa—the stop-spindle ; Fb—the stop body ; Fc—the stop-spindle locking collar ; Fd—the index collar; Fe—the stop body mounting bracket*

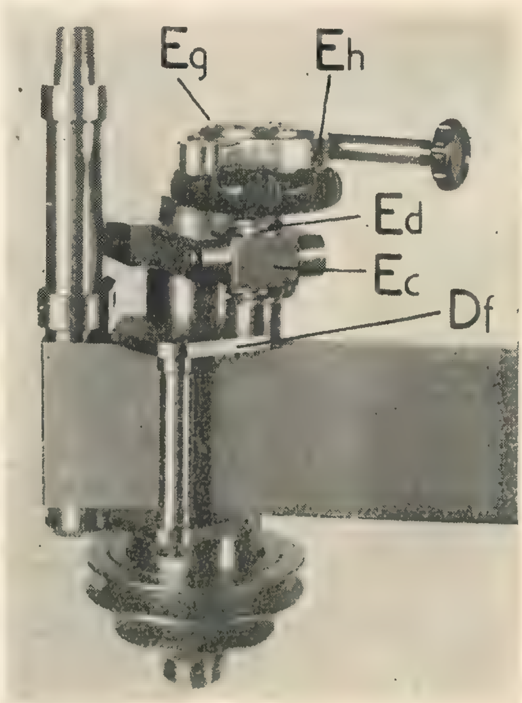


Fig. 39. *Df—the head clamp-plate; Ec—the trunnion block; Ed—the raising-screw; Eg—the cover plate; Eh—the screw clamp-bracket*

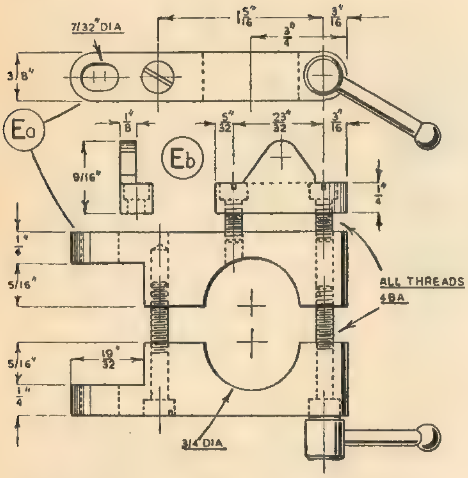


Fig. 40. The head clamp-bracket and stop-plate

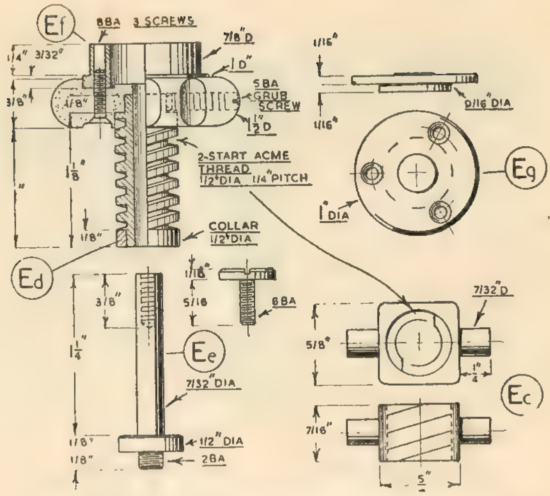


Fig. 41. Ec—the trunnion block; Ed—the raising-screw; Ee—the raising-screw spindle; Ef—the finger-wheel collar; Eg—the cover plate

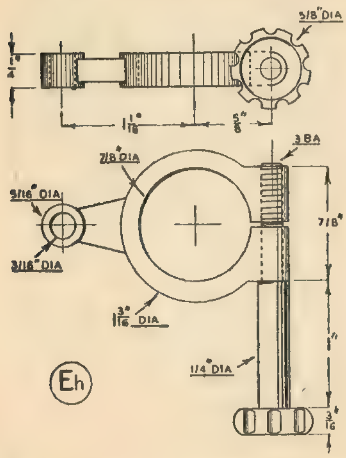


Fig. 42. The raising-screw clamp-bracket

bracket can be secured, and the Bowden control set, after the position of the feed-screw has been adjusted. The anchorage for the fixed point of the Bowden wire is by means of the small bracket plate *Ej*; this fitting is made in two parts, and clamps to the pillar *Dd* which, it will be remembered, is fixed to the head link-bar.

The details of the Bowden mechanism are shown in Fig. 44; the stud on the left is the fixed point and that on the right is secured to the bracket *Eh*, which is clamped to the collar of the finger-wheel. The return spring is carried in a sliding spring-box, and the strength of this spring must be sufficient to actuate the feed-screw and so feed the cutter into the work. However, a heavy spring is not needed, as the screw mechanism provides considerable mechanical advantage.

The other end of the Bowden casing is housed in an adjustable nipple which is attached to the tracing arm by means of the clip *Ek*. The fork soldered to the end of the Bowden wire is connected to the handle *El*, and this handle is pivoted to the hand grip *Em*. The hand grip is bent to shape from a piece of sheet metal, and is secured to the tracing arm by means of a clip. Although, in practice this arrangement has been found to work satisfactorily, some may prefer to fit a retaining catch to the hand lever, so as to leave both hands free for adjusting the position of the guide stencil when spacing the lettering.

The Depthing Stop

It is, of course, most important that all letters and figures of similar type should be engraved to a uniform depth, otherwise the strokes composing the letters will vary in width and an unsightly appearance will

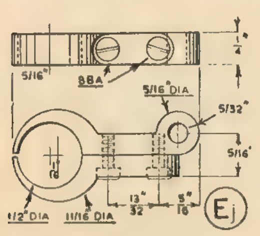


Fig. 43. The Bowden wire anchorage clip

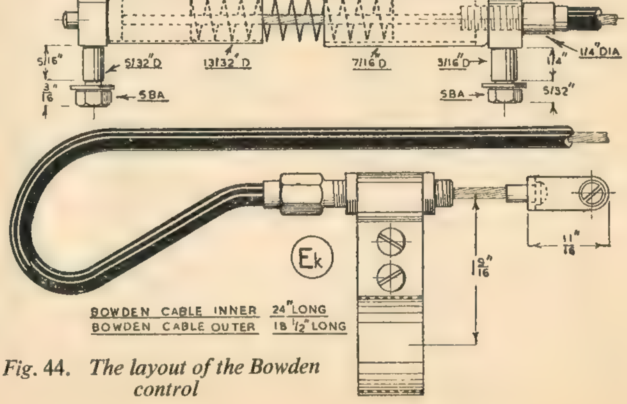


Fig. 44. The layout of the Bowden control

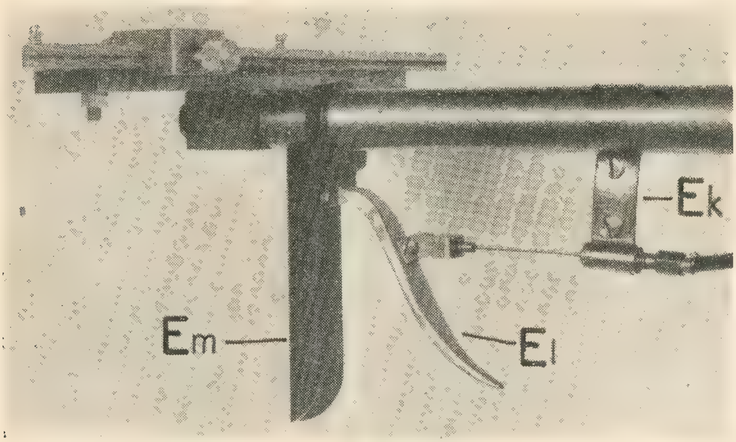


Fig. 45. The Bowden wire operating mechanism

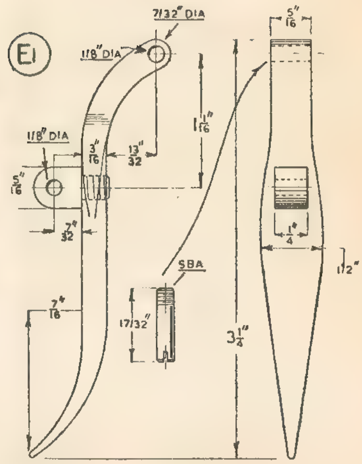


Fig. 46. The hand lever

result. To ensure uniformity, therefore, a rigid type of micrometer stop is fitted for controlling the downward movement of the cutter head.

The stop itself is attached to the head-link pillar *Dd*, and the spindle of the stop, on coming into contact with the stop-plate *Eb*, prevents any further downward movement of the cutter head.

The stop spindle *Fa* is threaded $\frac{1}{4}$ in. × 40 t.p.i., and its integral index collar is engraved with twenty-five graduations to indicate axial movement in thousandths of an inch.

The body part *Fb*, into which the spindle screws, is coned and also slit at its lower end; when, therefore, the closing collar *Fc* is tightened, the spindle becomes securely locked in position after an adjustment has been made. As shown in the photograph, Fig. 38, the adjustable index collar *Fd* is mounted on the lower end of the collar *Fc*, and is engraved with a zero line for setting the stop to give the depth of engraving required.

At its upper end, the body of the stop screws into the small bracket *Fe*; this part is slit so that, when contracted by the clamping-screw, it becomes securely fixed to the pillar *Dd*.

It will now be clear that, when the Bowden wire is pulled by the hand-lever, the quick-pitch raising-screw will be rotated and will carry the cutter head upwards. On releasing the hand lever, the spring fitted to the Bowden wire will rotate the raising-screw in the reverse direction, and the cutter head will travel downwards until the stop-plate by coming into contact with the depthing-stop prevents further movement.

This completes the construction of the engraving mechanism, and it remains to describe the mounting of the motor, together with the belt drive to the cutter head. In addition, in the concluding article, some suggestions will be made for operating the machine.

(*To be continued*)

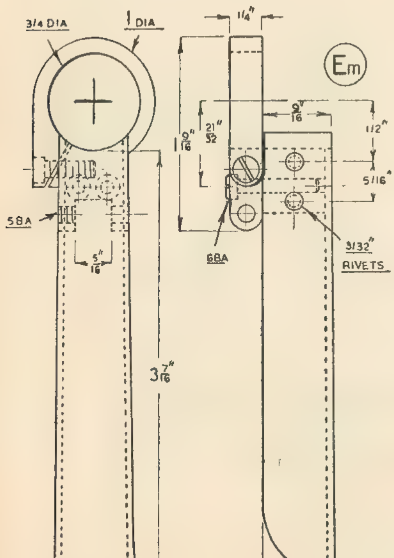


Fig. 47. The hand grip

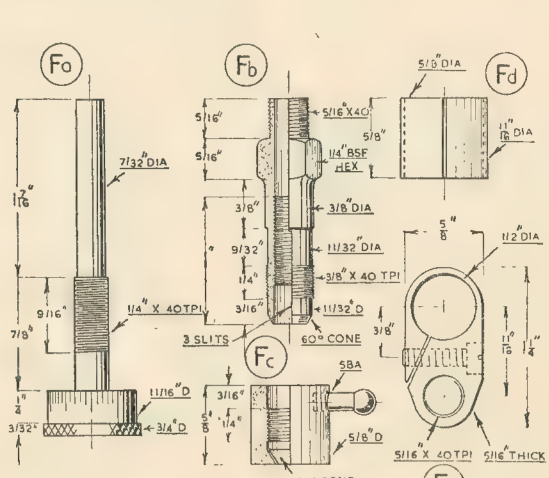


Fig. 48. Details of the parts of the depthing stop

Some Light on Tangye Engines

By G. B. Round

THE following notes have been inspired by the model Tangye engine recently described under the title of "More Utility Steam Engines," by Mr. E. T. Westbury, who mentioned with regret the loss of all records and drawings by Tangye's Ltd. Well, if this source of information is denied to us, we must look elsewhere and here we are more fortunate, for D. K. Clark in his *Treatise on Steam Engines and Boilers*, published by Blackie & Co., in 1889, describes with drawings and a wealth of detail, no fewer than three types of Tangye horizontal engines.

The first one to be described is the prototype of the model recently dealt with by Mr. Westbury, and the drawings and description are of the smallest engine in the range made by Messrs. Tangye's, of only 2 nominal h.p., the bore and stroke being 4 in. and 8 in. respectively. We cannot do better than quote D. K. Clark's description in full, as follows:—

"The Tangye type of horizontal steam engine of the smaller powers, is shown by Fig. 454, in which the frame, while supplying a wide base, combines this with the back connection supplied by the Corliss frame. The base extends from the face of the cylinder to and inclusive of the pedestal. The cylinder is overhung, and is bolted to and supported by the front cylinder-cover, which is cast in one with the frame. The guides for the crosshead, and the pedestal, also are cast in one with the frame and the cylinder-cover; and a continuous connection is made between the cylinder and the main shaft. The frame is a hollow casting, of great stiffness, well shown in section. It is held down to the foundation by five bolts—two on each side, and one at the pedestal.

"The cylinder is 4 in. in diameter, having 12.57 square inches of area, with a stroke of 8 in., making 180 turns, or a speed of piston of 240 ft. per min. It is not steam-jacketed. The steam-ports are $\frac{7}{16}$ in. wide and $2\frac{1}{2}$ in. deep, making an area of about 1/11 of that of the piston. The slide-valve is driven by an eccentric keyed on the shaft. The piston-rod is fully $\frac{3}{4}$ in. in diameter. The flywheel is $2\frac{1}{2}$ ft. in diameter, and 3 in. wide at the rim, the face of which is turned; the wheel weighs $1\frac{3}{4}$ cwt. The main shaft is straight, and is 2 in. diameter, with a length of 28 in. The steam-pipe is $\frac{3}{4}$ in. in diameter, or about 1/28 of the piston in sectional area. The exhaust-pipe is $1\frac{1}{4}$ in. in diameter, having about 1/10 of the area of the piston. The slides or guide-surfaces are flat, and the motion-blocks, of cast-iron, are adjustable by double-nuts.

"The crosshead-pin is 1 in. in diameter by $1\frac{1}{2}$ in. long, and is let into the crosshead with a taper head, and a nut at the other end. The connecting-rod is 1 in. in diameter at the ends, and $1\frac{3}{16}$ in. at the middle; and is 20 in. in length, having five times the length of the crank. The crosshead brasses are fixed by a

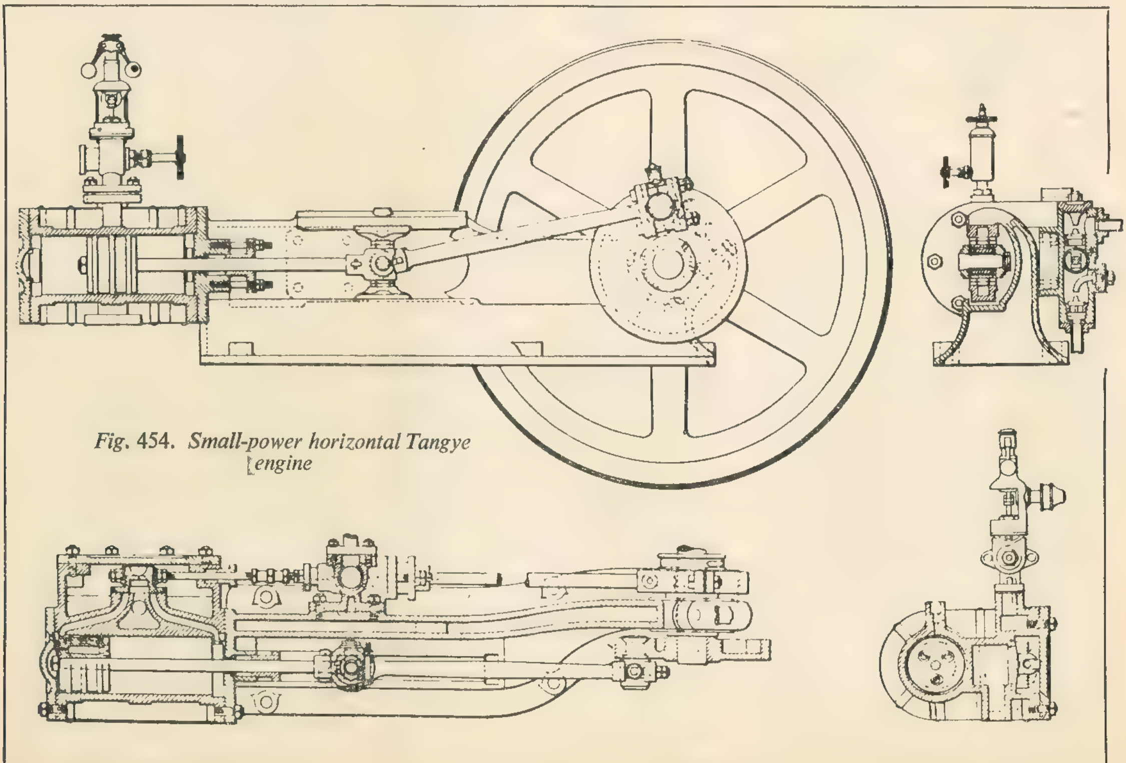


Fig. 454. Small-power horizontal Tangye engine

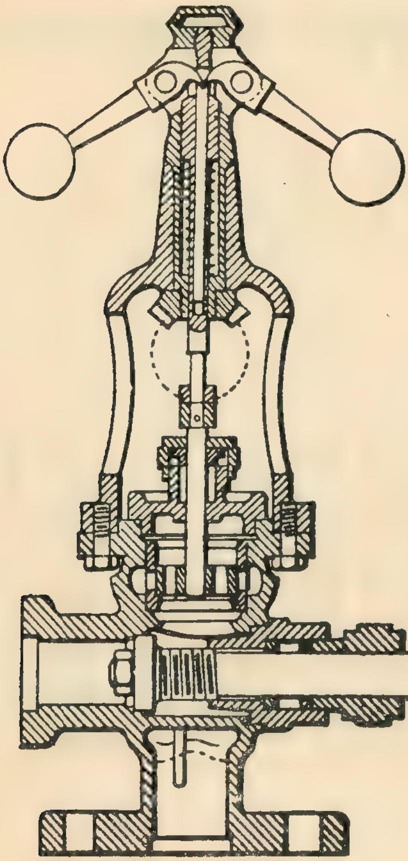


Fig. 445. *Tangye combined governor and stop-valve*

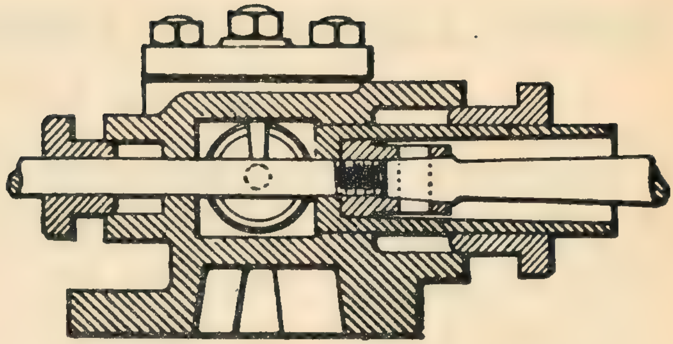


Fig. 456. *Feed pump for small-power Tangye engine*

wedge with a nut at each end. The crankpin-end is fitted with a cap and two bolts. The frame, between the cylinder and the centre of the shaft, is 30 in. in length, of metal about 7/16 in. thick. The centre-line of the cylinder is 6¾ in. above the level of the base. The pillow-block or pedestal is inclined at the angle of 45 deg. with the centre-line, and gives a bearing for the shaft 2 in. in diameter and 3 in. long. The cap is fastened with two cotter bolts and nuts. The crank-pin is 1⅜ in. in diameter and 1¾ in. in length. It is fitted into and through a crank-disc, 10½ in. in diameter, keyed on the shaft and riveted over. The governor, Fig. 455, runs at 500 turns per minute. It is driven by bevel gearing, and acts on a throttle-valve seated with the stop-valve, in one casting. It is fitted with a helical spring on the spindle to control the flight of the balls. The compression of the spring, and correspondingly the speed of the engine, are adjusted by a nut at the top of the spindle. The feed-pump is fixed on the back of the frame, and is worked by the eccentric-rod, which also drives the valve-spindle, in line, as shown in Fig. 456."

The engines were supplied either right or left-hand, also in couples or pairs, and apparently the feed pump, and in sizes over 8 h.p., the variable expansion gear, were extra on the price, which for the 2 h.p. engine, in 1889, was £25 and £3 extra for the feed pump. The largest size listed was 25 h.p., with a cylinder 16 in. diameter by 28 in. stroke, the flywheel being 9 ft. in diameter with a 12 in. face.

The writer remembers about a dozen of these engines, many years ago, with others of differing types, driving the agitators on furnaces at a large chemical works, and well recalls the flywheels, which were of the wide-face and thin-rim type, very different from that shown in the illustration to " Utility Engines " in the January 7th issue of THE MODEL ENGINEER, although one can never be quite sure that no other type of flywheel was fitted. This is an ideal engine for the modeller who strives for historical accuracy and correct detail, and it is worth remembering that a model with a 1-in. bore cylinder would be one-quarter full size.

The second type of Tangye engine described by D. K. Clark, is that known as the Soho pattern, of a larger size than the previous example, and again we cannot do better than repeat the description in full :—

" In the Soho engine, self-contained, the main-shaft is cranked, and has two bearings on the frame base-plate, one on each side of the crank. An engine of 10 nominal horse-power, Fig. 457, has a cylinder which is not steam-jacketed, 10 in. in diameter, with a stroke of 12 in., designed for a speed of 150 turns, or 300 ft. of piston, per min. The front cylinder-cover and the pedestals make one casting with the frame, and the cylinder is overhung. The distance from the centre of the cylinder to the centre-line of the crank-shaft is 55½ in. The frame is looped to make room for the crank; and it has a continuous base or bearing on the foundation. It has two sides, 12½ in. high, formed with horizontal flanges at the top, which serve as slides for the crosshead-guides above the piston-rod.

" The slides are 7½ in. in length, and present a slide surface of 49 sq. in. The crosshead and piston-rod work between the sides of the frame, at a level of about 8 in. above the base-level, measured to the centre-line of the piston-rod. The crosshead or motion-block pin is 1¾ in. in diameter and 4½ in. long. The crankshaft is 3⅜ in. in diameter, and is bent to the shape. The pin or central bearing is 3¼ in. in diameter and 5 in. long. The journals are each 6¾ in. long. The journal brasses are parted at the angle 45 deg.

" Space is provided between the arms of the crank and each pillow-block to receive the valve-eccentric at one side, and the driving pulley for the governor at the other side. The eccentric-rod is of cast-steel, double-flanged or of I-section. It is carried straight to the valve-spindle, passing through an opening

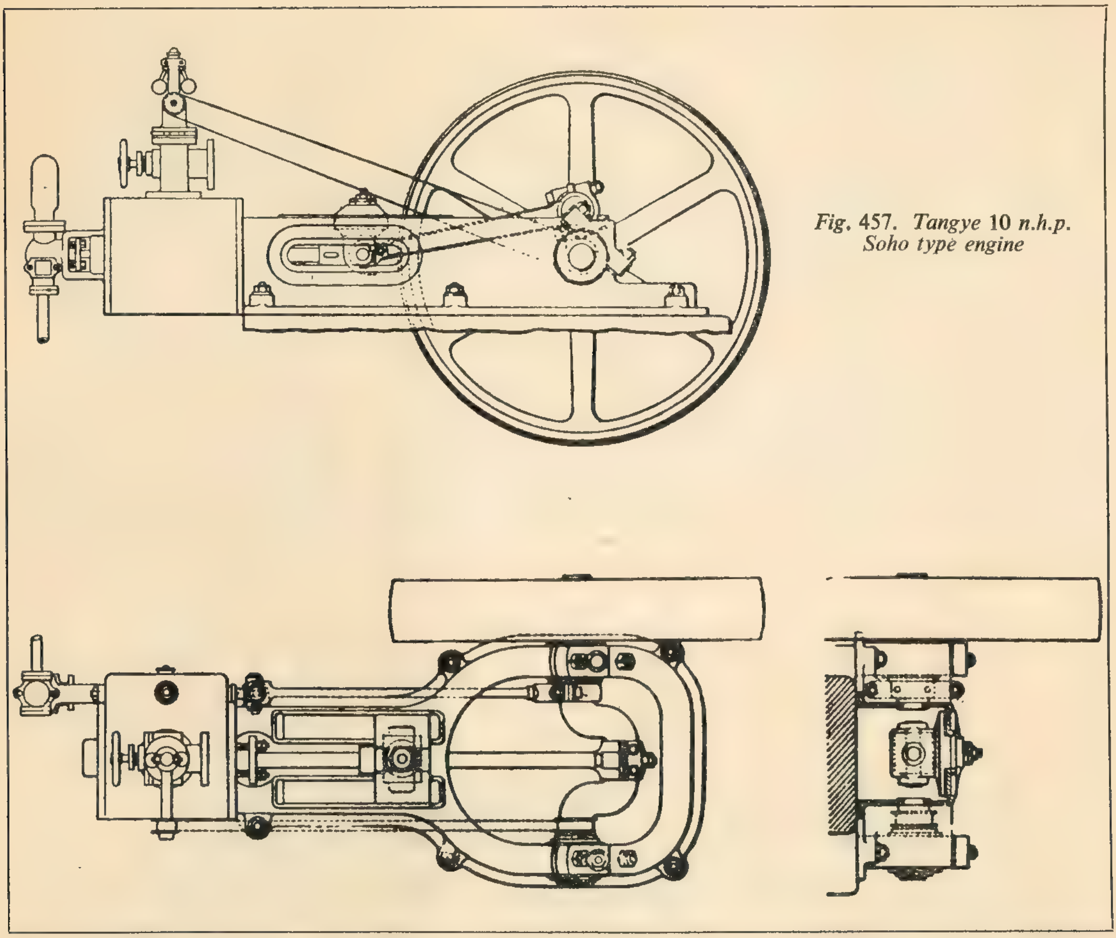
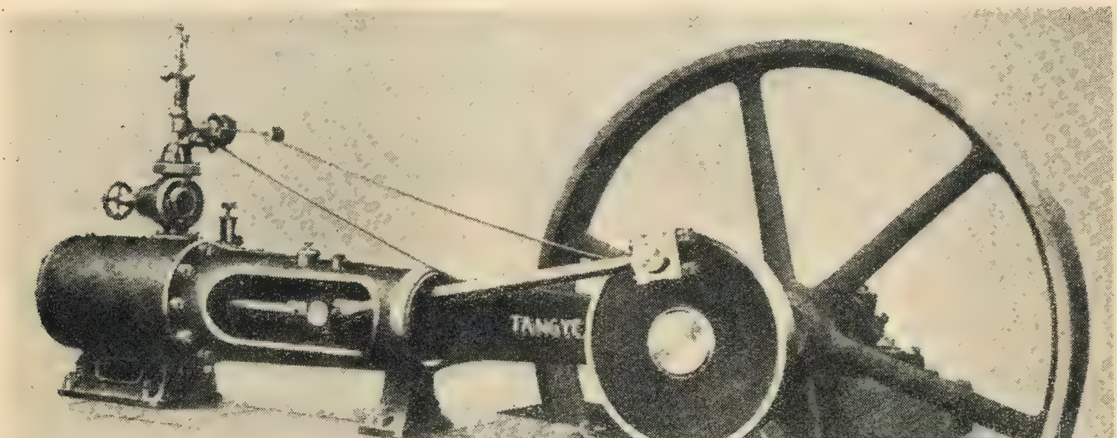


Fig. 457. Tangye 10 n.h.p. Soho type engine



Tangye horizontal girder-type steam engine

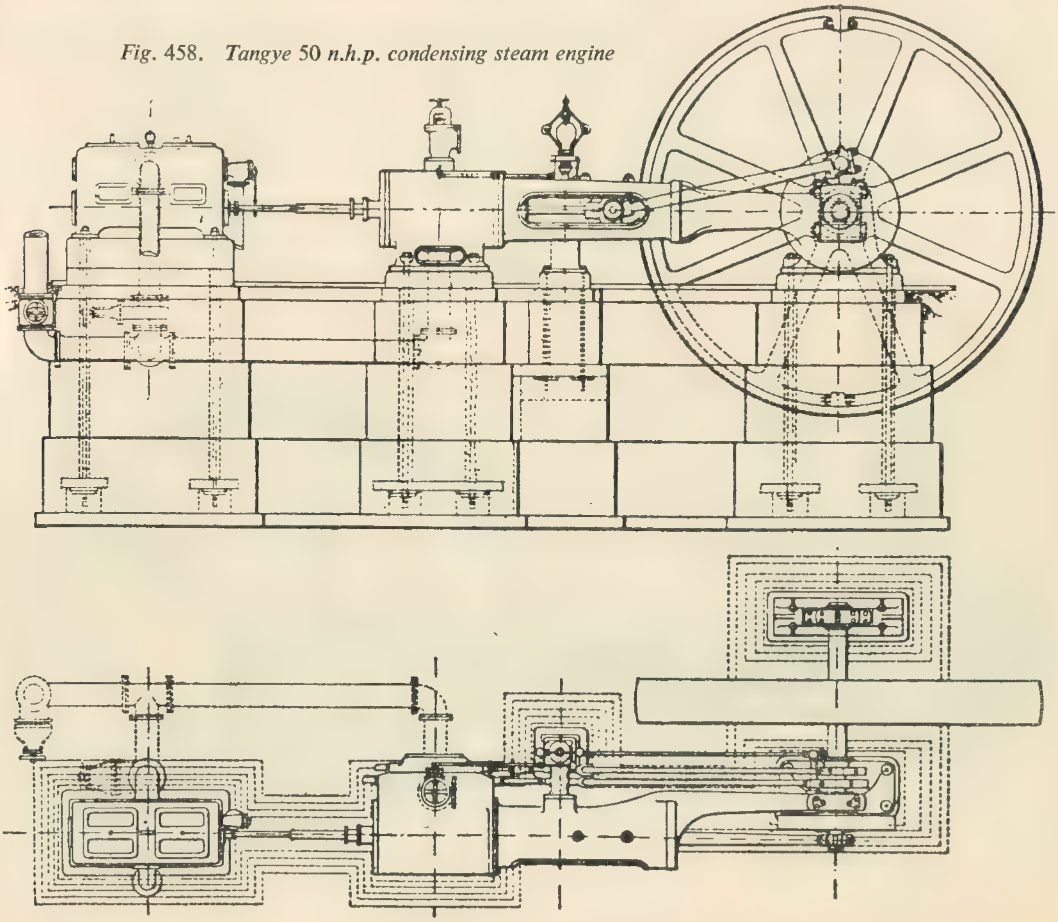
in the frame; and comparatively short steam-ways are obtained. The feed-pump is worked by a prolongation of the valve-spindle, at the back of the valve-chest. The connecting-rod is 3 ft. in length, or six times the length of the crank. It is of cast-steel, of a double-flange or I-section. It has a solid or closed end for the crosshead-pin, with a wedge adjustment, and a cap with longitudinal bolts and nuts for the crank end. The flywheel is 50 in. in diameter, and 8 in. wide; it is keyed on the main-shaft outside the frame. The steam-pipe is 2½ in. diameter. The steam stop-valve is placed over the cylinder, the governor over the stop-valve. The exhaust-pipe is 3 in. diameter. The frame is secured to the foundation with six holding-down bolts and nuts. The extreme dimensions of the engine over all are 8 ft. 5 in. by 4 ft. 6 in. The engine weighs 1 ton and the price (in 1889) is £66."

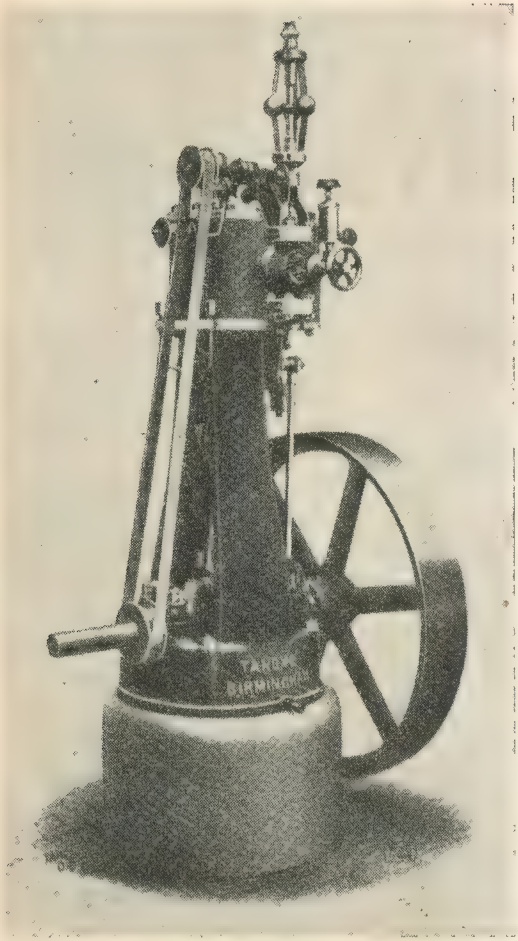
The remaining engine described is larger still, with the frame of the girder pattern. Again quoting from D. K. Clark :—

"Horizontal steam engines of large size are of the type shown in Fig. 458. The cylinder, condenser, and pedestal are directly supported on the foundation, and the cylinder is connected to the pedestal by a girder frame—in plan suggestive of a bayonet, and familiarly known as the bayonet frame.

"The engine shown in the figure is of 50 nominal horse-power. The cylinder is 22½ in. in diameter, with a stroke of 40 in., and is steam-jacketed. The piston-rod is of steel, 3 in. diameter. The engine is designed to run at a speed of 53 revolutions per minute, equivalent to a piston-speed of 353 ft. per min. According to these proportions, 8.3 circular inches of piston-area are allowed per nominal horse-power. The Meyer expansion valve is employed, and the valves are worked by two independent eccentrics. The expansion-gear can be adjusted by means of a hand-wheel, while the engine is in motion, to cut-off at any point in the stroke from 0 per cent. to 75 per cent. The steam-pipe is 5½ in. diameter and the exhaust-pipe is 8 in. The flywheel is 14 ft. in diameter, and 24 in. wide at the rim, which is turned on the face. It has eight arms, and is cast in two halves, which are bolted together with turned bolts at the centre and at the rim. It weighs six tons. The main shaft is of steel, 7¾ in. diameter, and 7 ft. 9 in. in length. The crank-journal is 10½ in. long, and the outer journal is 9½ in. long. The crank-bearing is so arranged, in three pieces, with wedge adjustment, that wear can readily be taken up. The crank-pin is keyed into a disc 4 ft.

Fig. 458. Tangye 50 n.h.p. condensing steam engine





Small vertical Tangye engine

$1\frac{1}{2}$ in. diameter, which is keyed on one end of the shaft. The connecting-rod is 8 ft. in length, 4.8 times the length of the crank. It has a solid end with a single bearing on the cross-head pin, and is made with a cap and two turned bolts and nuts for the crank end. It is $3\frac{1}{2}$ in. in diameter at the ends and $4\frac{3}{4}$ in. at the middle. The bearing of the crank-pin is 7 in. long.

"The frame is a girder, in one casting with the front cylinder-cover and the pedestal; 11 ft. 9 in. in length between the cylinder and the centre of the mainshaft. It is formed cylindrical to join the cylinder, and is bored out to form guides for the crosshead. The remaining part of the frame towards the pedestal is hollow, where it is 15 in. deep and $7\frac{1}{2}$ in. wide. The base of the crank pedestal is 4 ft. long by 22 in. wide; that of the outer pedestal 4 ft. 6 in. by 15 in. The pedestals stand 2 ft. 1 in. high, and the speed of the engine is regulated by an ordinary Porter's governor driven by gearing from the crankshaft. It is fitted with a dashpot, and is connected to a throttle-valve between the cylinder and the steam stop-valve."

An illustration of one of these girder-type steam engines from an old Tangye catalogue has survived and is reproduced with these notes. It will be seen that it is of the non-condensing type, and is fitted with a combined throttle and stop-valve; the governor in this instance being of the well-known Pickering type.

The remaining illustration reproduced is also from an old catalogue and shows a very neat form of vertical steam engine for small powers, as made by Messrs. Tangye. This would make up into a most attractive model, the circular base forming a welcome change from the usual rectangular pattern. Unfortunately, no dimensions are available, and the two illustrations are practically all that remains of the catalogue. Both reproductions, however, show clearly the design of flywheel generally fitted to the smaller engines made by this old established engineering company.

The Demand for Glass-Fibre

BECAUSE so many readers have written to us asking for further information about glass-fibre processing techniques which have been outlined in recent articles in this journal, we feel that the following summarised information may be of general value.

In this country, the use of glass-fibre-reinforced resins is still in its early stages, although most authorities are agreed that these materials have a big future. The materials are being supplied on a large scale to industrialists (mostly boat and car-body builders) and a recent development is the supply of comparatively small batches of materials in the form of repair kits.

Model makers all over the world are showing great interest in the possibilities of these materials, and it is understandable that they should be interested in sources of supply; but it must be at once emphasised that the large suppliers are not, at present at any rate, particularly interested in meeting that growing demand. There is good reason to suppose, however, that they are *aware* of the demand for small supplies to members of the public for various purposes, including handicrafts and model-making, and it may well be that they intend to make the materials more readily available, if only through retail suppliers.

Meanwhile an enterprising business man in this country has had the foresight to obtain bulk supplies and make up kits of a size suitable for model makers, and these are already being supplied by retailers under the name "Bondaglass." The name of the wholesaler is P. Smith, and the address is 40a, Parsons Mead, Croydon, Surrey.

Where the large suppliers are concerned, probably the best-known names are those of Fibreglass Ltd., Ravenhead, St. Helens, Lancs., (for glass-fibre mat, cloth, tape, etc.) and Bakelite Ltd., 12-18 Grosvenor Gardens, S.W.1 (for polyester resins etc., catalysts, accelerators, etc.) but there are quite a number of others, including the following: Marglass Ltd., Birmingham and Fothergill & Harvey Ltd., Manchester (glass cloth), Scott Badder & Co., Ltd., 109, Kingsway, W.C.2 (resins) and Microcell Ltd., 56, Kingsway, W.C.2 (laminates). Concerns known to be well-experienced in full-scale manufacture of complete structures are W. J. Todd Ltd., Wykes Regis, Weymouth, and the North East Coast Yacht Building and Engineering Co. Ltd., Blyth, Northumberland.

QUERIES AND REPLIES

"THE M.E." FREE ADVICE SERVICE. Queries from readers on matters connected with model engineering are replied to by post as promptly as possible. If considered of general interest the query and reply may also be published on this page. The following rules must, however, be complied with:

(1) Queries must be of a practical nature on subjects within the scope of this journal.

(2) Only queries which admit of a reasonably brief reply can be dealt with.

(3) Queries should not be sent under the same cover as any other communication.

(4) Queries involving the buying, selling, or valuation of models or equipment, or hypothetical queries such as examination questions, cannot be answered.

(5) A stamped addressed envelope must accompany each query.

(6) Envelopes must be marked " Query " and be addressed to THE MODEL ENGINEER, 19-20, Noel Street, London, W.1.

Safety of Steel Boiler

I have a vertical steel boiler built by Goodhand in 1950, 12 *in. diameter* × 30 *in high, with centre flue and cross water-tubes. The shell is* $\frac{3}{16}$ *in. thick, and the flanges slightly thicker. This has not been used since the latter part of* 1950, *and before being stored it was blown down under steam and a small quantity of steam cylinder oil was poured into the boiler in order to guard against rust and corrosion, and then sealed up as much as possible. The soot, however, was left in the firebox and centre flue, in a mistaken idea that this would help to prevent rust. I have been told that in spite of the precautions taken to prevent rust and corrosion, the boiler is useless and that it would be a dangerous proceeding to steam it again.*

It is fitted with a small manhole, which is held in place by a central bolt and nut, and a bridge-piece. After removing the bridge-piece, I have so far found it impossible to remove the manhole cover. The interior of the boiler appears to be oily, but there is a certain amount of flake rust in the firebox and centre flue.

(1) *Is the boiler safe to be used again at a working pressure of* 70 *lb. per sq. in., if it is tested hydraulically to* 140 *lb. per sq. in.* ?

(2) *What is the best method of removing the manhole cover* ?

(3) *How can I remove all traces of the oil that was put into the boiler* ?

(4) *If no trouble develops under* 140 *lb. hydraulic test, can I assume that the boiler is safe* ?

(5) *I propose fitting a spear-head type of superheater in the centre flue, which is* 3½ *in. diameter, with a wet and dry header* ½ *in. diameter, with three-element* ¼*-in. pipes. The steam pipe to the engine is* $\frac{5}{16}$ *in. diameter. Do you think this will prove satisfactory* ?

K.E.W. (Marham).

We see no reason to believe that this boiler should be considered unsafe after having been stored from the latter part of 1950 up to the present year.

(1) Subject to a successful hydraulic test at 140 lb. per sq. in., it should be quite suitable for work at 70 lb. per sq. in.

(2) If the manhole cover is rusted in, we suggest that it should be given a liberal soaking in penetrating oil and left for a few days, renewing the oil if it tends to soak away or dry up.

(3) A weak caustic solution, or strong washing soda, in hot water, should remove all traces of the oil which was put into the boiler.

(4) In the case of the hydraulic test, it is a good principle to keep a very careful observation of all parts of the boiler inside and out, in case of any bulging taking place, which would indicate weakness. To facilitate this, gauges might be made to apply in various places and check any tendency to distortion. As a further safeguard against any deterioration of the boiler, drill tests might be made in various places, preferably near the lower part of the boiler where mud or sludge may have collected, and by means of a gauge which could be inserted through the holes, any decrease in the thickness of the plates could be detected. The holes should afterwards be closed by means of screwed plugs.

We have not had any definite experience with the type of superheater referred to in vertical boilers, but there does not appear to be any reason why it should not be just as successful with this type of boiler as with locomotive boilers.

Diesel Engines

Will you please let me have a definite answer to the following question: Can a compression-ignition engine which is not fitted with a fuel injection-pump be correctly described as a diesel engine ?

L.J.H. (Henley-on-Thames).

The term " diesel engine " is used very loosely at the present day, and we have often drawn attention to the fact that few, if any, modern engines of any type really correspond to the definition of the engine patented and developed by the late Dr. Rudolf Diesel, in which it was stipulated that combustion must take place at constant pressure, and not as an explosion.

Even the fitting of a fuel injection-pump does not fulfil these conditions, as the modern type of fuel injection-pump and sprayer is very different in construction and working principle from that used on the original diesels. The so-called modern diesel, as used in full-sized practice should, correctly speaking, be defined as a compression-ignition solid-injection type engine, whereas the so-called diesel in miniature size is an engine using an explosive mixture, ignited automatically by the heat of compression, with sudden rise of pressure.

Vibrator Operated Pump

I seem to remember a description in THE MODEL ENGINEER *of a water pump working on the vibrator principle. I have, however, been unable to find any trace of this in any of the old numbers in my possession, and I should be glad of any information on this subject.*

L.W.B. (Coventry).

It is possible that you may be referring to the aerator pump sometimes used in small aquaria. Some types of aerators are operated by a vibrator working on a.c. electric current supply at 50 cycles, and their purpose is to pump a small quantity of air through the water to keep up the supply of oxygen to enable the fish to breathe.

While it would not be impossible to operate a water pump by means of a similar vibrator, we are of the opinion that it would be extremely inefficient, owing to the high speed, as the water could not be pumped at such a high speed as air because of its greater inertia.

You may, however, be referring to a pump operated by pulsations, as several water pumps on this principle have been constructed, the best-known being the Pulsometer type of pump, which is operated by steam acting directly on the water without pistons or other mechanical parts, with the exception of a single ball valve which is employed to admit and cut off steam alternately to two vertical water vessels, to the lower end of which are fitted suction and delivery valves to deal with the water.

This does not work at such a high rate as the vibrator type of pump referred to above, but the rate of pulsations is determined by the inertia of the water, and, is therefore, automatically controlled.

Headgear . . . .

Every one a model !

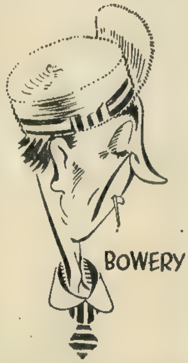
By C. R. Fox

Cutting-out instructions for the "Swindon Flatat"

NOW that spring is upon us, many young men's thoughts are lightly turning towards track days, and exciting events amongst the live steam fraternity. Many an engine is being removed from its winter quarters, and overhauls and cleaning are going on apace.

Much the same sort of thing is happening in the house, the poor spiders are being rudely ejected from their places of hibernation (that is if spiders do that sort of thing). The rag and bone man is in great demand and doing a roaring trade. This worthy, in exchange for a few coppers or a potted plant or two, will undertake to remove old boots, thoroughly broken-in gardening clothes complete with body heat, and any other old article of apparel beloved of the mere male.

It was whilst smarting somewhat under one of these indignities that inspiration came upon me and a salvage plan was put into operation. I would first explain that I am an enthusiastic locomotive fan, and thoroughly enjoy all the track work and driving that comes my way. I, in common with most other enthusiasts have often come well and truly unstuck with the good lady of the house, the chief cause of complaint being the large quantities of superheater oil and smuts deposited on the pillow-case, after a successful afternoon's run. The wiseacres will no doubt retort "Ever tried washing your head before retiring ?" To that I would say I don't like washing my head because apart from waking up in the morning looking like a "Birch broom in a fit," I quickly catch cold that way. No! — The answer is, prevention is better than cure.



Another joy in locomotive driving which must be endured to appreciate the pleasant sensation and the fun of playing fireman, is the occasion when a red hot cinder nestles two inches from the parting, and naturally enough in the thickest part of the thatch. The unlucky recipient is usually unaware of this miniature pyrotechnic display for quite a time, until the pleasant sensation of warmth on the cranium, and the gesticulations of the onlookers indicate that something is amiss. The truth suddenly dawns, the driver claps on his anchors, falls off his truck in a flurry and proceeds to comb out tufts of burning hair. All very good entertainment value and, if properly timed, can rival the "Keystone Cops."

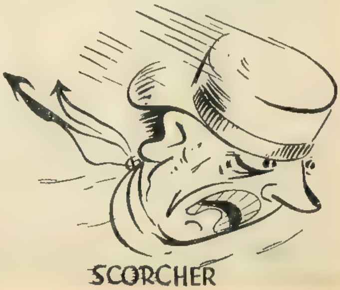
Now brothers, we can lay all these bogies in one fell swoop. That old felt hat that was rescued from the dustbin is the answer to the maiden's prayer. The conversion from the orthodox head garment to a useful and compact driving cap can be effected in a matter of a few minutes ; a few deft cuts with a pair of scissors, and lo ! and behold !—another lease of life for an old friend.

The Millinery "Know-how"

Lay the hat down on something flat and with a piece of tailors' chalk or some similar marking device, strike two lines from the side of the hat and more or less parallel to one another to the front of the brim; this forms a peak. Cut along the outside of these lines and carefully up to, but not including, the hat band and lining ; continue around the circumference and along the other peak line. The crown should be punched in and carefully rounded to assume a somewhat "pork pie" effect. The head gear thus formed may then be crammed on at the most suitable angle, and the general effect may be observed in a mirror. Usually, the result is quite pleasing as it stands, but individual peak styles can be varied at will. The front corners may be rounded if desired, and the peak generally fashioned to suit the peculiar style of beauty below.

To illustrate the versatility of this form of protection, I have included one or two rough sketches which show very clearly how contrasting styles can be effected from the most unpromising sources. The proud owner need never worry about meeting his friends in the same creation two weeks running.

There will, of course, be plenty of rude remarks for the first time, this can be put down to a form of "tomcattyness" and should not be allowed to influence the wearer against the obvious utilitarian value of the head gear.



READERS' LETTERS

● **Letters of general interest on all subjects relating to model engineering are welcomed. A nom-de-plume may be used if desired, but the name and address of the sender must accompany the letter. The Managing Editor does not accept responsibility for the views expressed by correspondents.**

A 30 c.c. "KITTIWAKE MAJOR" PETROL ENGINE

DEAR SIR,—I trust readers will be interested in these photographs of a "Kittiwake Major" 30 c.c. petrol engine, made from castings by George Kennion, except the fan mounting bracket, which was designed by an acquaintance of mine as a magneto bracket for the 15 c.c. version. We find, however, that the magnetos we have tried are not successful when used in straight-running boats at low speeds.

One photograph shows the push-rods unshipped, and the extension tube lowering the float chamber can be seen. In the second photograph can be seen the fan bracket, Stuart Turner contact-breaker, the pressure relief-valve with leak-off fed to the timing gears and cams. The pressure gauge was fitted for setting pressure only. The oil filler cap is fitted with a ball-valve for crankcase ventilation.

This engine was mentioned in your readers' letters column during an argument on plug oiling, and it is the one with the pressure-breaking groove at the bottom of the skirt, and the drain holes drilled therein and also below the lowest ring.

These photographs were taken before the fan was fitted, as it was my last chance of availing myself of the services of the experts.

I am still hoping that it will be installed in Micky Fawcett's *Barbara II* (F.G.4).

Yours faithfully,

East Ham. A. E. CLAUSON.

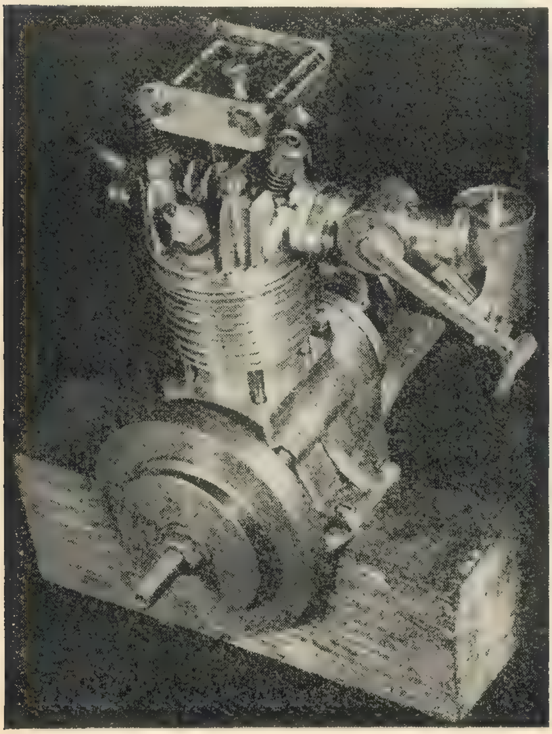
LAPPING FLAT SURFACES

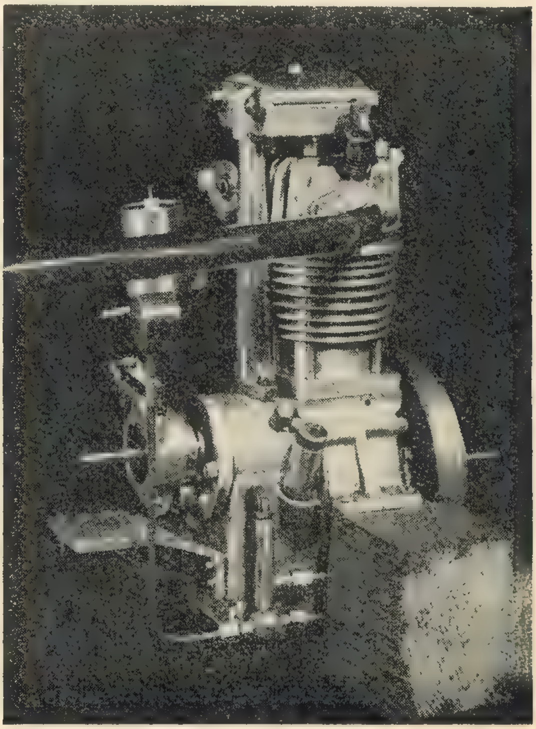
DEAR SIR,—I feel that I may be of some help to your correspondent R.O.S. of Louth in his query on flat lapping in THE MODEL ENGINEER for January 28th, 1954.

In this operation it is customary to use a cast-iron plate having a true flat surface with diagonal lines cut into it. Lapping paste is then applied to the plate and forced into its surface. I find that this can be accomplished by rolling across the plate under heavy hand pressure, either a hardened roller, or the hardened outer ring of a roller bearing.

After rolling the plate surface evenly, all traces of lapping compound are removed by working in paraffin or some soluble light oil. A small amount of clean lubricating oil is then applied to the surface of the lap, which is used in the normal way, moving the object with even pressure in a "figure-of-eight." The surface may be recharged as necessary in the above manner.

I have found that laps used in this way retain their true surface for a much longer period than when used in the more common way, with the compound wearing the lap almost as much as the object to be lapped.





A high degree of finish may be obtained by using several laps with progressively finer grades of lapping compound.

When using a roller for forcing the compound into the surface of the lap, pressure may be exerted while rolling, through a bar laid on top of the roller.

Yours faithfully,
Vancouver, Canada. RONALD W. HYATT.

STANDARDISATION

DEAR SIR,—With reference to the letter of Mr. Tracey in the issue of April 22nd, I could not agree more. When we wish to transfer our thoughts towards one another, we don't want to go all round the bush to get there. I am a retired tool-room turner, and have dealt in English and metric measurements. Why have 1/64, 1/32, $\frac{1}{16}$, $\frac{1}{8}$, $\frac{1}{2}$, 1 in., especially in complicated jobs where it is a potential source of errors? I always bring these fractions to decimals, and add them that way, but why do this, when metric measurements are so simple, and can be reckoned in one's head?

Also, consider the time factor. It is much quicker to deal in millimetres than English units. As he says, why have number and letter drills? In rush jobs, why hunt for a chart to see what these sizes mean? Stamp the decimal on the drill and you've got it!

Yours faithfully,
Greenford. W. J. STEVENS.

DEAR SIR,—In reply to J. W. Tracy, the size of a wood screw is the diameter of the head in 32nds. less 2, i.e., a number 6 is $6 + 2 = 8$; $8 \div 32 = \frac{1}{4}$ in. diameter.

Mr. Tracy has, however, touched upon one of my "hobby-horses" with this subject. Weights under the two systems in use today (Avoirdupois and Apothecaries) are 437½ and 480 grains to ounce; imagine weighing 7½ drams (Av.) one dram containing 27 11/32 grains! Whilst the American fluid ounce is 456 gr., the English fl. oz. is 4 per cent. less, the English pint is 20 fl. oz. the American pint is 16 fl. oz.

It can be argued that to save all this bother, one may well work in metric measure; very well, to provide the link between linear, volumetric and weight measures, the gram is defined as 1 cubic centimetre of pure water at 4 deg. C., 1,000 c.c. being 1 litre. The official 1/1000th part of the litre is 1 millilitre, therefore, 1 c.c. = 1 m.l., but this is not so! Admittedly the difference is only slight (27 parts per million). Physicists, however, work to 1/10,000,000th part of 1 deg. C. with accuracy (did I hear someone say $\pm$ 0.00025 in.?)

Perhaps it will be said that this does not concern us as model engineers? Some 12 to 18 months ago the N.P.L. re-measured the speed of light; to do this they made a resonating chamber with an accuracy of $\pm$ 0.0000001 in. English linear measure, the latter statement being necessary as the American inch is *not*, repeat not, the same size as its English counterpart, so where and how is one to standardise?

Considering these facts, one may well be allowed to ask: "How long is a piece of string?"

Yours faithfully,
Bradford. GEOFFREY MASON.

DEAR SIR,—Mr. Tracy's letter suggests the abolition of gauge sizes and their replacement by diameters in thousandths of-an-inch; a proposal that might be put forward by a mere scientist, but the practical engineer knows better. All these things *are* standardised, often to ten-thousandths, the gauge-number is merely a convenient label for easy reference, usually by a number of only two figures. The complete specification is available in tables when needed, it may take half-a-dozen lines of print. William Clarence de Bompstable Woolfardisworthy-Smith must be completely specified in this manner on his birth-certificate, but for practical purposes we refer to him as "Bill."

Specification by diameter in thousandths of-an-inch has been tried and found wanting. Many years ago it was officially recommended that wires for electrical purposes should be ordered by diameter instead of by gauge-number; it was found that many more mistakes in ordering were made than with the S.W.G. numbers, often due to the misplacing of a decimal point or the omission of an essential "0" (A. T. Adam, *Wire Drawing*, Witherby 1925). The difficulty is that the significant figures of different sizes are sometimes the same, thus 0.036 in. is 20 S.W.G., but 0.0036 in. is 43 S.W.G. For copper wires and cables, of large cross-section, the specification in thousandths is suitable and is used; resistance-wire is usually small; it is apparently never sold by diameter, but always by S.W.G. number. Your correspondent's query about the meaning of the numbers of wood-screws is easily answered; the shank diameter of a number n screw is $(14n + 50)$ thousandths, the diameter of the countersunk head is twice this, the angle of countersink is 90 deg., the mean root diameter is $\frac{5}{8}$ of the shank diameter. It is quicker to write for a No. 8 screw than for a 0.162.

The difficulty is that the interval between one stock size and the next is necessarily different at the two ends of the range; usually we need a constant percentage change, as in the B.A. screws, where the diameter of successive numbers decreases by approximately 11 per cent. Furthermore, for different purposes the fineness of division between stock sizes differs; below $\frac{1}{4}$ in., over a hundred standard diameters are found necessary for drills; for printer's type a mere ten "point-sizes" are sufficient. It is found more convenient to specify the size of type in which this is printed as "8-point" than as "0.11067 in."

All these things *are* standardised (printer's type to a closer tolerance than most things), but experience shows that different products need different units of "step" between consecutive stock sizes, and that the thousandth of an inch is seldom the convenient unit.

Yours faithfully,
Cambridge. "NUMERATOR."

Next Week . . .

"NETTA"

"L.B.S.C." takes you a stage further with this popular locomotive. Next week he describes the machining and fitting of the cylinders for the 2½-in. and 3½-in. gauge versions.

OLD STAGERS

"Northerner" describes some interesting models which are "centenarians-plus."

AND NOW THE "BUMBLE BEE"

Starting the construction of the "Bumble Bee." a new two-stroke stationary engine designed as a worthy successor to the "Busy Bee" auxiliary cycle motor.

TAKE HEART!

Limited workshop equipment need not deter you even from locomotive building, and we show you that elaborate equipment is not essential if you make the best use of what you have.

CARBIDE TIPS

Further information on the use of carbide-tipped lathe tools follows up the recent lively discussion on this subject in these pages.

EVERYTHING IN ITS PLACE

For readers who delight in a tidy workshop, with all tools to hand, "Duplex" describes how to make a tool tray for the lathe.

FOCUS ON READERS' WORK

We include another two-page feature illustrating interesting work by our readers themselves.

WITH THE CLUBS

The Southern Federation of Model Engineers

At the quarterly meeting of the Federation held in April, it was decided to explore the possibility of making contact with other affiliations and federations of M.E. societies with a view to mutual assistance and co-operation.

It was also decided that the Federation outing this year should be to the Swindon Locomotive Works on a date in July.

The opinion was expressed that where societies were in a position to hold exhibitions of their own, it was not in their best interests to lend models or take stands at local shows, combined hobbies exhibitions and the like.

Hon. Secretary: R. A. READ, 90, Woodside Road, Salisbury, Wilts.

Harlington Locomotive Society

We re-opened the multi-gauge railway, together with an exhibition, on Easter Saturday. It was a pleasure to have such a large crowd of spectators old and young, who enjoyed themselves to the full, as passengers on the trains, examining the exhibits, or just sitting around in country-like surroundings, enjoying a cup of tea.

As regards the exhibition, which was extremely well patronised, the exhibits showed remarkable skill in locomotive building, ranging from "OO" gauge to 7¼ in. gauge and incidentally, showed a distinct tendency towards the Victorian-Edwardian periods, for example:—Stirling G.N.R. Single, and "Titfield Thunderbolt," these, together with other examples, will be seen running in due course.

Finally, the B.R. Western Region very kindly lent some of their well-known posters, which gave a distinctive touch of colour to a most successful day.

Hon. Secretary: P. WAKE, 25, Sipson Lane, Harlington, Middx.

Tees-side S.M.E.E.

At a meeting held in Middlesbrough on Wednesday, April 21st, the first of a promised series of talks on "Gears and Gearing" was given by Mr. J. Worthington, who is an official of the society and Borough Architect of Middlesbrough. In the first instalment the speaker discussed the principles underlying the design of tooth form, both involute and cycloidal and of the determination of the diametral and circular pitch of spur gears. The talk was illustrated by lucid diagrams.

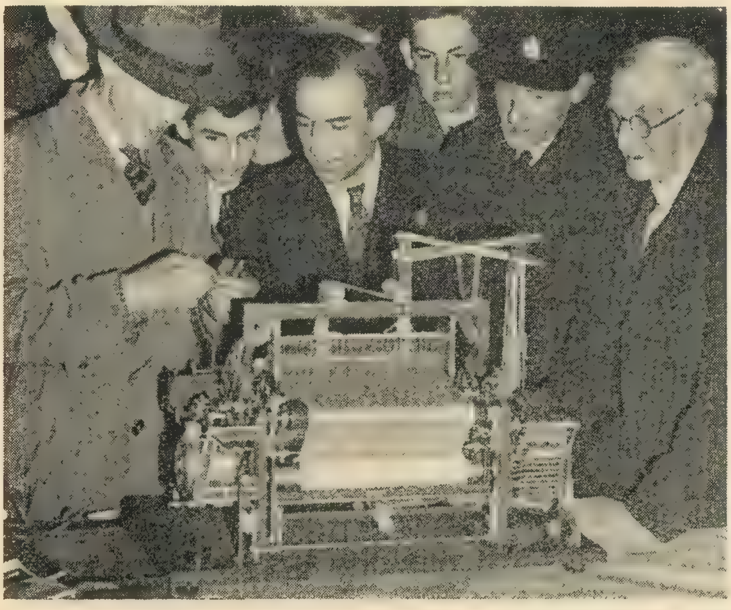
Hon. Secretary: J. W. CARTER, 28, East Avenue, Billingham, Co. Durham.

Ickenham & District S.M.E.

The "stars" featured in a film show given recently were locomotives, both road and rail. Thanks are due to Mr. W. J. Hedges, of Weymouth, for the chance of seeing his films of the several road locomotives and steam tractors, which have been preserved by him and other enthusiasts in that area, and also to Mr. C. R. L. Coles for showing his films of the Old Oak Common Engine Sheds of British Railways, Western Region. The showing of the latter film was most appropriate, as a large party of members had the privilege of a tour of inspection of these sheds on March 21st. In several instances members were able to examine working parts of prototypes, which were causing "headaches" in modelling for use on our 5-in. gauge track.

Members were very pleased to welcome Mr. K. N. Harris to their meeting on March 19th, when he spoke on the automatic control of steam boilers with particular reference to the working of White and Stanley steam cars. Members were also able to welcome their contemporaries from other societies to hear Mr. Harris.

Hon. Secretary is MR. L. A. GROSS, of 16, Thurlstone Road, Ruislip, Middlesex.



At the 1954 *exhibition organised by the Northern Association of Model Engineers, J. Worswick (in trilby hat) of Oldham joins the weft before demonstrating his model fustian loom at work to interested spectators*

Bradford Model Engineers Society

Running days on our track have been arranged as follows:—

Saturday, June 12th.—Open day.
Sunday, July 4th.—Club invitation day.
Saturday, July 12th.—Open day.
Saturday, August 28th.—Open day (track birthday celebration).

The Hon. Secretary is now F. H. TEMPEST, 41, Primrose Terrace, Manningham, Bradford, 8, Yorks.

Golden Gate Live Steamers, Inc.

The G.G.L.S. boasts the longest 2½ in. gauge track in the world (1,330 ft.). Any challengers? The road is multi-gauged, having 3½ in. and 4¾ in. tracks, also. Wm. Brower, chairman of the track committee, has installed a new transfer-table at the firing-up tracks which makes for easier operation.

Without wishing to brag too much, we are probably one of the most active live steam groups now operating. Recently, eleven engines were in steam, the following Sunday nine showed up. These were all members' engines, just out for a run, without any pre-arrangement or scheduled meet.

Meetings are held the second Friday of each month. At a meeting Harry Cook gave an interesting demonstration of home-casting in brass, producing the steam-chest of his "Maid of Kent," from pattern to rough casting, while the members watched in admiration. Larry Duggan screened his movie, showing the construction and grand-opening of the club track.

Tentative plans call for a "Model Steam Engineering Show" similar to those held in Britain.

Visitors are always welcome to our meetings, and to operate over the club track, provided that a boiler test to 50 per cent. over working pressure is agreed to.

Secretary: L. J. DUGGAN, 1070, Green Street, San Francisco, California, U.S.A..

Harrow & Wembley S.M.E.

The following meetings have been arranged:—

May 30th, at the society's 3½-in. and 5-in. continuous track, at the B.R. L.M. Region Sports Ground, Headstone Lane.

June 9th.—A lecture by Mr. Sparey, on "My Useful Gadgets in the Workshop," at the society's headquarters, Heathfield School, College Road, Harrow (opposite Harrow-on-the-Hill Station). Visitors are welcome to all our meetings.

Hon. Secretary: K. D. CARTER, "Hedgely," 4, South Approach, Moor Park, Northwood, Middx.

Forest Gate Model Power Boat Club

At the Regatta to be held on May 30th, at Victoria Park, Hackney, the programme, commencing at 10.30 a.m., is as follows:

(1) Nomination race. (2) Steering event. (3) Speed events for Class "A," Class "B," Class "C" and Class "C" (restricted) boats.

Bournville Model Yacht and Power Boat Club

The Annual Whitsuntide Regatta will be held on Whit Monday, June 7th, at the Valley Parkway, Bournville Lane, Bournville, Birmingham, commencing 11.30 a.m. Programme will include steering competition, 500 yd. events for "C," "C" restricted, "B," and "A" class hydroplanes. Light refreshments will be available.

Hon. Secretary: M. FAIRBROTHER, The Boathouse, Valley Parkway, Bournville, Birmingham.

Aylesbury & District S.M.E.

We were pleased to act as hosts to the Luton S.M.E., at our last meeting, which was devoted to a talk by Mr. J. N. Maskelyne. Mr. Maskelyne gave us a delightfully informal chat about locomotives, and recent loco tests, also a few of the interesting results. Being continually in contact with locomotive affairs both large and small, Mr. Maskelyne

is just the right person to complete the liaison between the modeller and the large scale world about him.

Please continue the good work Mr. Maskelyne, and thank you for a very entertaining evening.

Hon. Secretary: E. H. SMITH, Mulberry Tree Cottage, Devonshire Avenue, Amersham, Bucks.

The Edinburgh & Lothians M.R.C.

Recent attraction has been a members night in which 20-minute talks were given by three members. Mr. Clutterbuck brought examples from his 3½" gauge garden railway, Mr. Northwood discussed his experiences in constructing his own "OO" layout, whilst a working demonstration and talk was given by P. D. Hancock on 2 mm. scale.

We have also had a most interesting demonstration and lecture on the building of model rolling stock by Mr. Gavin Wilson, who kindly came from Broughty Ferry, and through the kindness of the Stephenson Locomotive Society our club was invited to their lecture by O. S. Nock, on Dynamometer Car Tests.

Hon. Secretary: ANTHONY MURRAY, Advocates Close, Opposite St. Giles, High Street, Edinburgh 1, Scotland.

The Society of Amateur Electrical and Mechanical Engineers

Although the growth in numbers, of the above society, was not rapid during the past year, it could be recorded that the Society, has so far achieved its first objective—an active membership. This has been further strengthened by the additional rule that every member must take his turn in the arranging of the programme.

A programme covering the next year was reviewed, and visits have been arranged for the summer months.

Hon. Secretary: W. K. WALLER, 37, Douglas Street, Derby.

THE MODEL ENGINEER DIARY

May 30th.—Forest Gate Model Power Boat and Engineering Society. Regatta for free running boats and speed events, at Victoria Park, Hackney, E.9.

June 5th and 7th.—Salisbury and District Model Engineer Society.—Exhibition at Market House, Salisbury.

June 5th.—Welling & District Model Engineering Society. Regatta for free running boats only, at Belvedere Recreation Ground.

June 7th.—Bournville M.Y. & P.B.C. Regatta at the Valley Pool, Bournville Lane, Birmingham. Commencing at 11.30 a.m.

June 12th.—St. Albans & District M.E.S. Invitation regatta. Free running boats only, at Verulamium, St. Albans, Herts.

June 13th.—Model Power Boat Association. National Speed Regatta at Verulamium, St. Albans, Herts.

June 14th to June 26th, inclusive.—The Plymouth and District Society of Model and Experimental Engineers. Exhibition at Pitt's Memorial Hall, Gibbon Street, Plymouth.

June 26th and 27th.—Birmingham Society of Model Engineers. National Loco Rally at Campbell Green.

July 3rd.—Vickers-Armstrongs Ltd. (Weybridge) Model Club. Annual exhibition, at V.A.B. Ltd., Sports Ground, Kings Head Lane, Byfleet, Surrey.

July 10th and 11th.—International Radio Controlled Models Society. Annual Contests for radio controlled models, to be held in Birmingham.—Model Boats on July 10th, and Model Aircraft on July 11th.

August 18th, 19th, 20th, 21st, 23rd, 24th, 25th, 26th, 27th and 28th. THE MODEL ENGINEER Exhibition, at the New Horticultural Hall, Greycoat Street, Westminster, S.W.1. Open from 11 a.m. to 9 p.m.

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CORRESPONDENCE

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Buck & Ryan for Lathes and Accessories, drilling machines, grinders, electric tools, surface plates, etc.—310-312, Euston Road, London, N.W.1. Phone: Euston 46€..

"Impetus" machines, wood planers, motorised drills, belt sanders, electric motors, paint sprays, air compressors, circular saws, etc. Catalogue.—JOHN STEEL, Castlefields, Bingley.

Yes, Sir! Myford M.L.7 and "Zyto" lathes from stock! No waiting. Dispatched same day. Deferred terms arranged with pleasure. Write, phone or call.—Ross & ALEXANDER (LONDON) LTD., 165-7, Bishopsgate, London, E.C.1. Phone Bishopsgate 2220.

Orders can again be accepted for ⅜″ bench drills, 20 d.p. gears, castings for our 4″ lathe, and all our standard lathe components. S.A.E. 3d. stamps for list.—PERFECTO ENGINEERING COMPANY (Machine Tools), 60, Stanley Street, Leicester. Phone: 20078.

Immediate Delivery from Stock. Myford "M.L.7" and "Super 7" lathes, Grayson, Super Adept lathes, bench planer, shapers, electric motors, small tools.—F. W. KUBACH, 12, Sylvan Road, London, S.E.19. Lib. 3311/12.

"Acorntools" and "Acorntools" De Luxe 5″ s.s. and s.c. lathes, also "Acorntools" 7″ stroke high-speed shapers and ½″ capacity capstan lathes can be supplied *ex*-stock. Hire purchase terms available. Send for literature and full details to the manufacturers of these machines.—THE ACORN MACHINE TOOL Co. (1936) LTD., 610-614, Chiswick High Road, Chiswick, W.4. Tel.: 3416-7-8-9.

Rebuilt Lathes. The Acorn Machine Tool Co. (1936) Ltd., offer rebuild to limits "Acorntools" and "Atlas" 10″ swing s.s. and s.c. lathes. Hire purchase terms are available. Write—610-614, Chiswick High Road, W.4. (Phone: CHI 3416).

New (Slightly Soiled) 2½″-3-jaw (reversible) scroll chucks (model 32/Burnerd, reduced from £5 8s. to £3 10s. (1s. 9d. p. and p.). List supplied on request.—JOHN MORRIS (CLERKENWELL) LTD., 64, Clerkenwell Road, E.C.1.

The 2½″ × 10″ E.W. Lathe. Unrivalled in its class. Plain lathe £13 4s. Fully convertible to back gear and screwcutting. Can be obtained on the easiest of terms from 5s. weekly. Send s.a.e. for details. Adept lathes, shapers, Perfecto shapers, Britinol blow lamps. No interest, no fuss credit terms. Details s.a.e.—WANSTEAD SUPPLY Co., 48, High Street, London, E.11.

Denbigh 5-Speed motorised bench drill. No.1 M.T. 3-phase, £15.-GRIFFITHS, Summerhill, Winsford, Cheshire.

Whiston for Nuts, Bolts, etc., rivets 1/32″ dia. up, plastic belt, silver solder, silver steel, screwed rod, ballraces, etc. Send for 1,000 item list.—K. R. WHISTON, (Dept. M.E.S.), New Mills, Stockport.

Britannia B.G.S.C. 4″ Lathe. Chip tray, makers' stand, 1/3 h.p., s.p. motor, chucks and accessories, £35.—MORSE, 8, Coles Lane, West Bromwich. Phone: Wednesbury 0978.

Desoutter Drill Guns, type A, ¼″, 230-250 V a.c./d.c., £5 5s.; Black & Decker type H ex-A.M. heavy duty, £5 18s. 6d., 200-220.—PATTERSON, 40, Ruxley Lane, Ewell, Surrey.

Myford "ML7" Lathe, in first class condition, 4″ s.c. chuck, set Belco adjustable taper mandrels, set of Crown collet chucks, boring bar, 3 carriers, and set of 12 Wimet lathe tools, today's value £67 10s., our price £49 10s., or deposit of £10 10s. and 12 monthly payments of £3 11s. 8d. Also a "XL" Junior B.G.S.C. lathe, 3½″ by 14″, change wheels, faceplate, countershaft, drill chuck, boring bar and set of Toledo H.S.S. lathe tools, bargain at £25 10s., or £7 10s. deposit and 12 payments of £1 15s. Carbide tipped lathe tools, ¼″, 5/16″ and ⅜″ square, £2 10s. set, ½″ square £3. Lathe boring bars with three tipped cutters, £1, from—CORBETT'S (LATHES), Stanton Hill, Sutton-in-Ashfield. Tel. 583.

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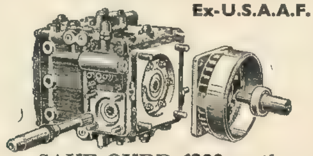

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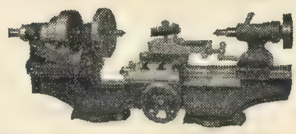

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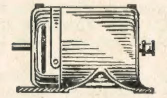

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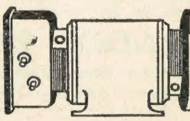

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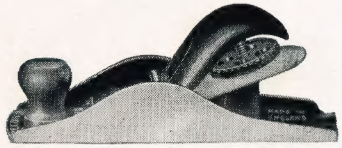

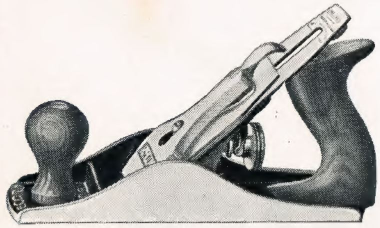

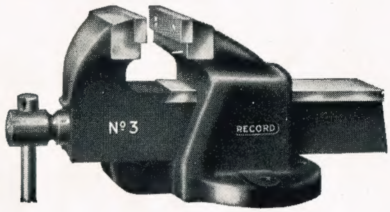

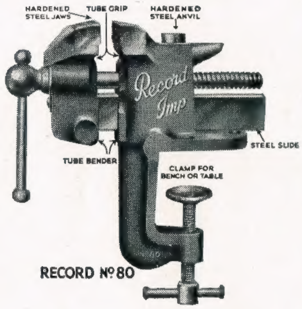

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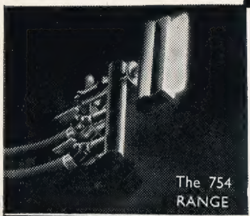

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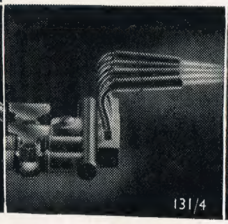

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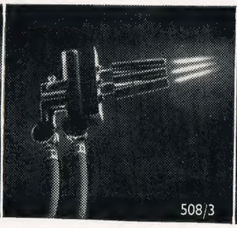

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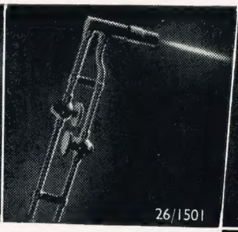

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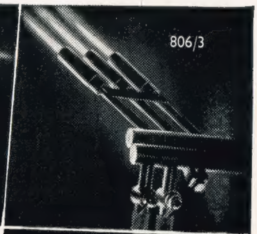

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